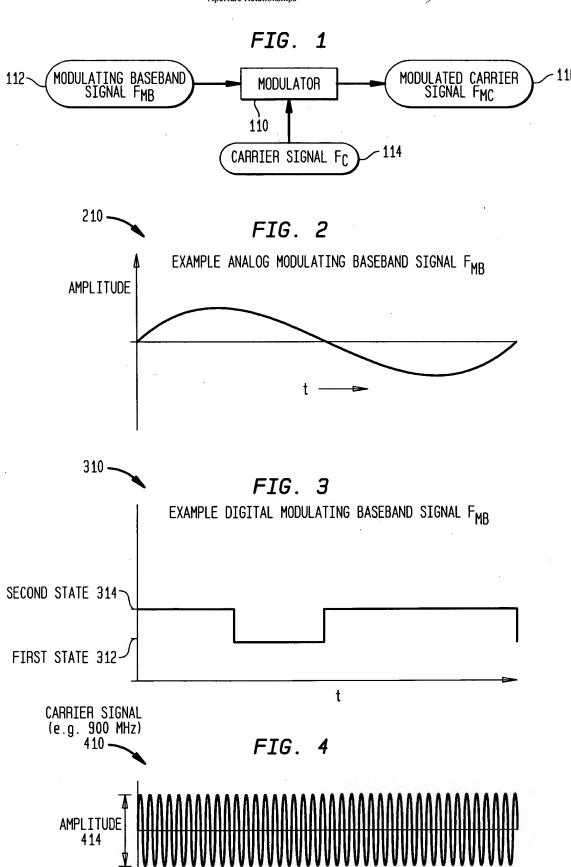
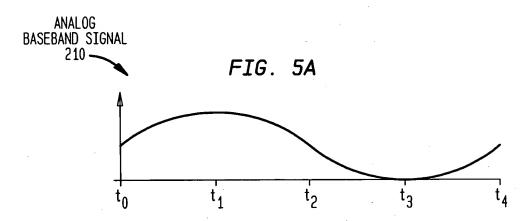


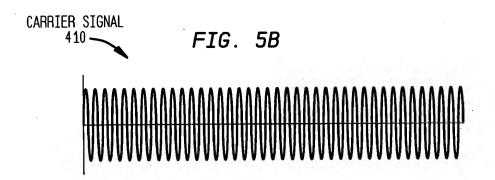
Replacement Sheet

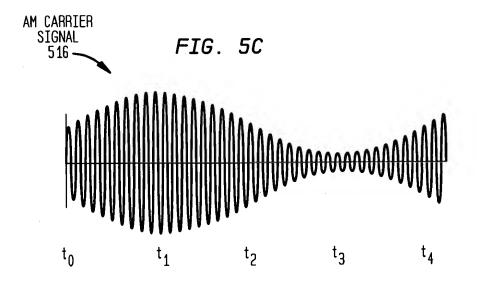
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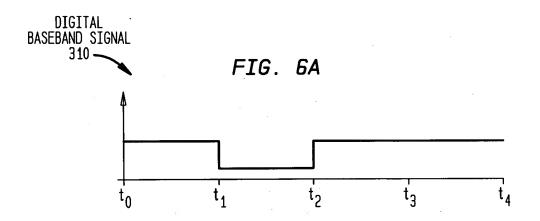
Replacement Sheet Sheet 2 of 284 Appl. No. 09/550,644; Filed: Apr 14, 2000 Dkt No. 1744.0010009; Group Unit: 2688 Inventors: Sorrells et al. Tel. No.: 202-371-2600

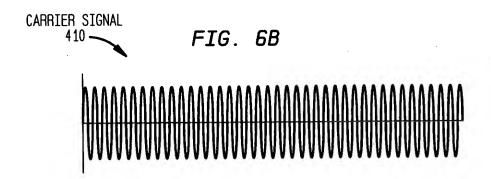


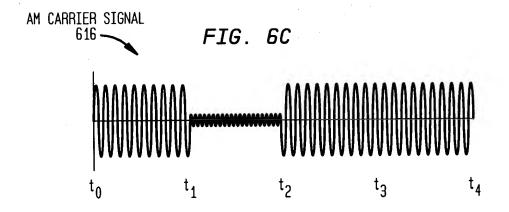




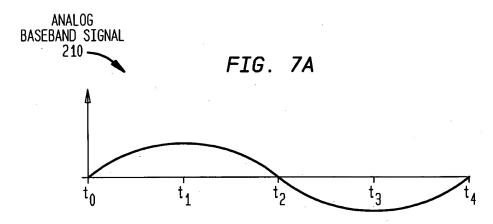
Replacement Sheet
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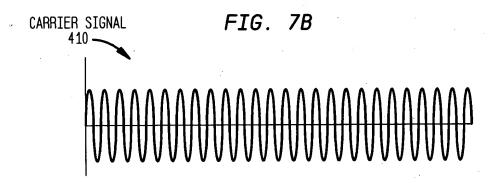


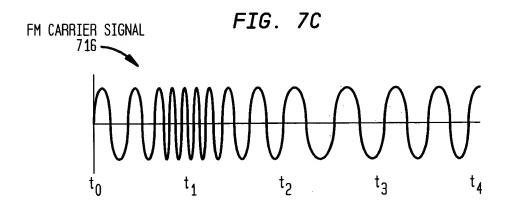




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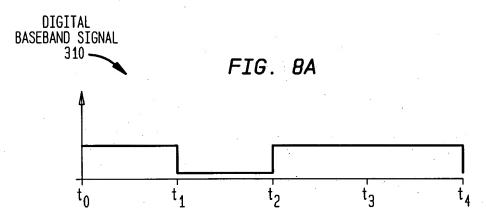


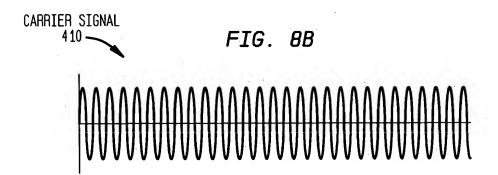




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Inventors: Sorrells et al.
Tel. No.: 202-371-2600
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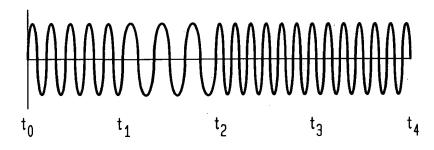
Electromagnetic Signal, Transforms for Same, and Aperture Relationships



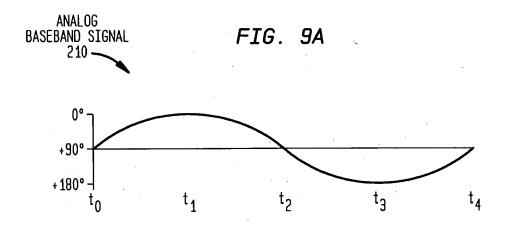


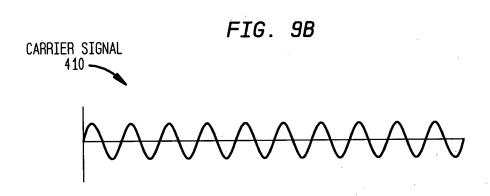
FM CARRIER SIGNAL 816

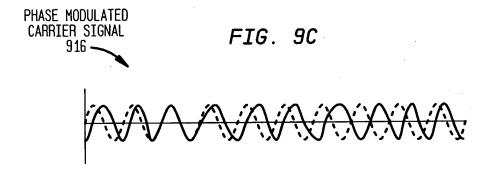
FIG. 8C



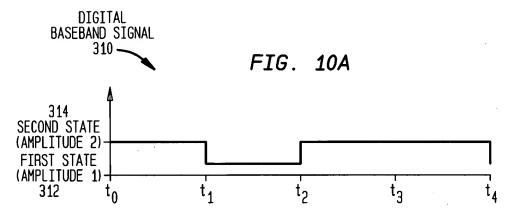
Replacement Sheet Sheet 6 of 284 Appl. No. 09/550,644; Filed: Apr 14, 2000 Dkt No. 1744.0010009; Group Unit: 2688 Inventors: Sorrells et al. Tel. No.: 202-371-2600 For: Method and System for Down-Converting

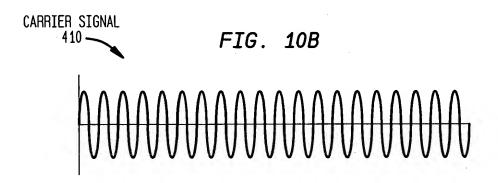


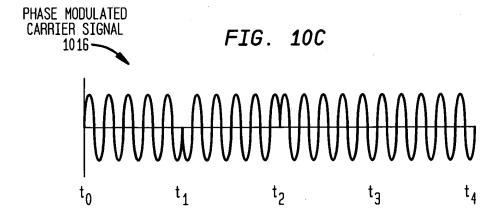




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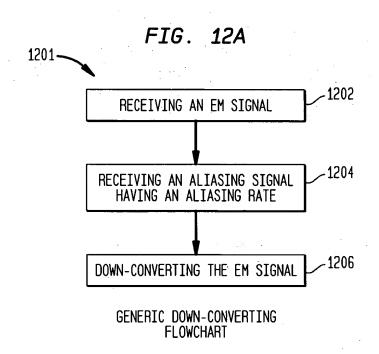


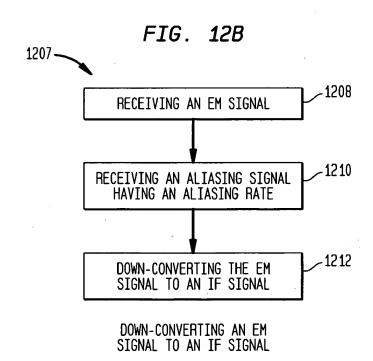




Replácement Sheet Sheet 8 of 284 Appl. No. 09/550,644; Filed: Apr 14, 2000 Dkt No. 1744.0010009; Group Unit: 2688 Inventors: Sorrells et al. Tel. No.: 202-371-2600 For: Method and System for Down-Converting an Electromagnetic Signal, Transforms for Same, and Aperture Relationships 置 STAGE 1124n (e.g., 11MHZ) 1118n (e.g.,59MHZ 置 STAGE 1124a 1119a~ (e.g.,830MHZ) FIL TER STAGE 눈 EM SIGNAL (e.g.,900MHZ)

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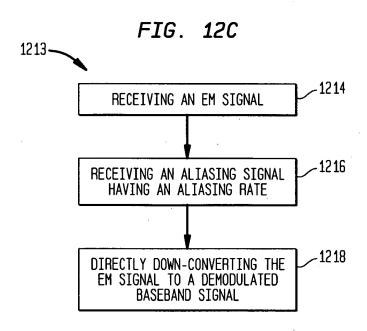


Replacement Sheet

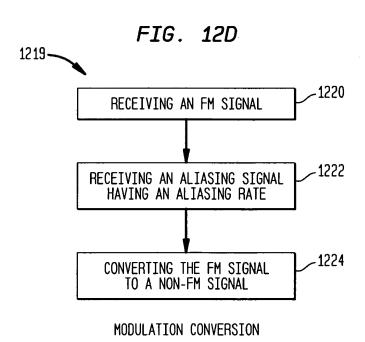
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Inventors: Sorrells et al. Tel. No.: 202-371-2600

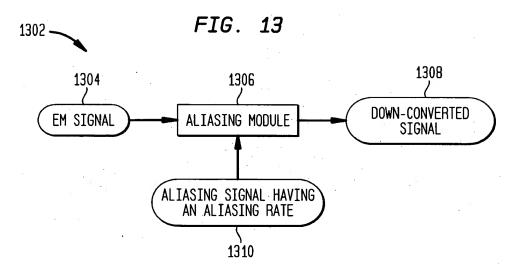
For: Method and System for Down-Converting an Electromagnetic Signal, Transforms for Same, and Aperture Relationships



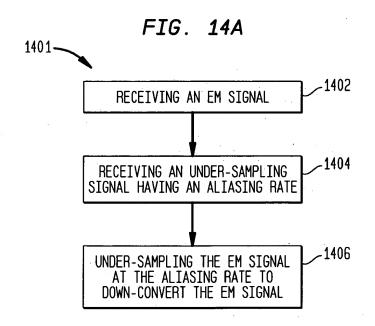
DIRECTLY DOWN-CONVERTING AN EM SIGNAL TO A DEMODULATED BASEBAND SIGNAL



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Aperture Relationships

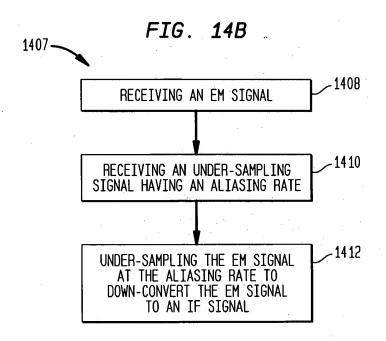


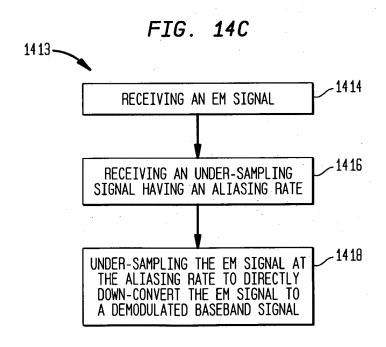
GENERIC DOWN-CONVERTING SYSTEM



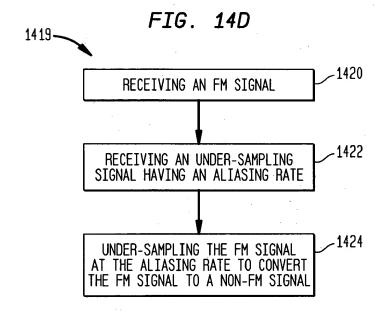
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Tel. No.: 202-371-2600

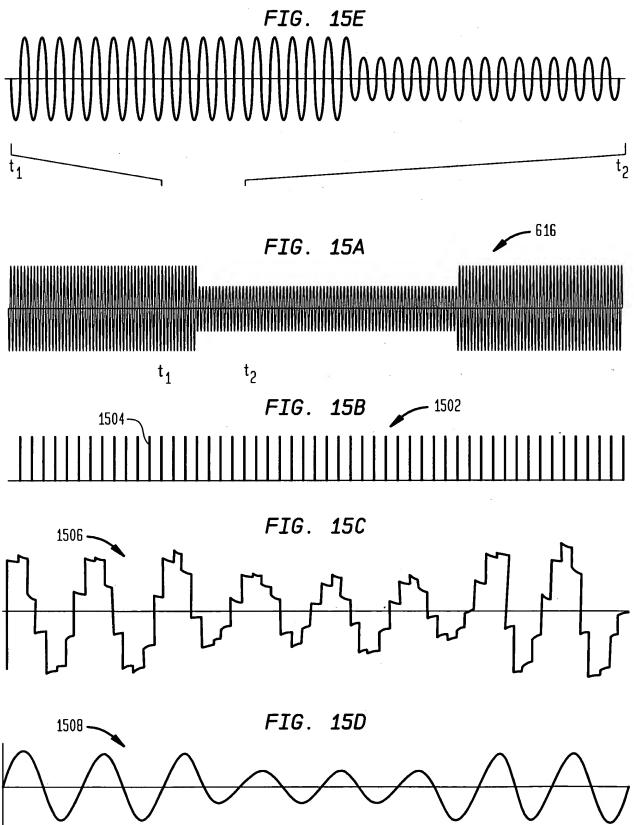




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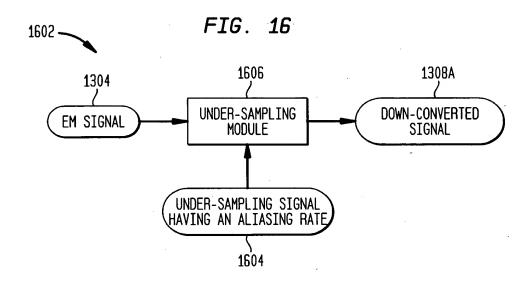


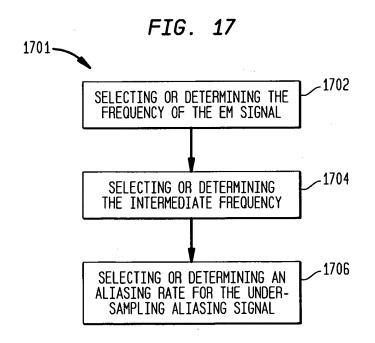
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Inventors: Sorrells et al.
Tel. No.: 202-371-2600 For: Method and System for Down-Converting an Electromagnetic Signal, Transforms for Same, and Aperture Relationships FIG. 15E  $\overline{t_2}$ - 616 FIG. 15A t<sub>1</sub>  $t_2$ FIG.

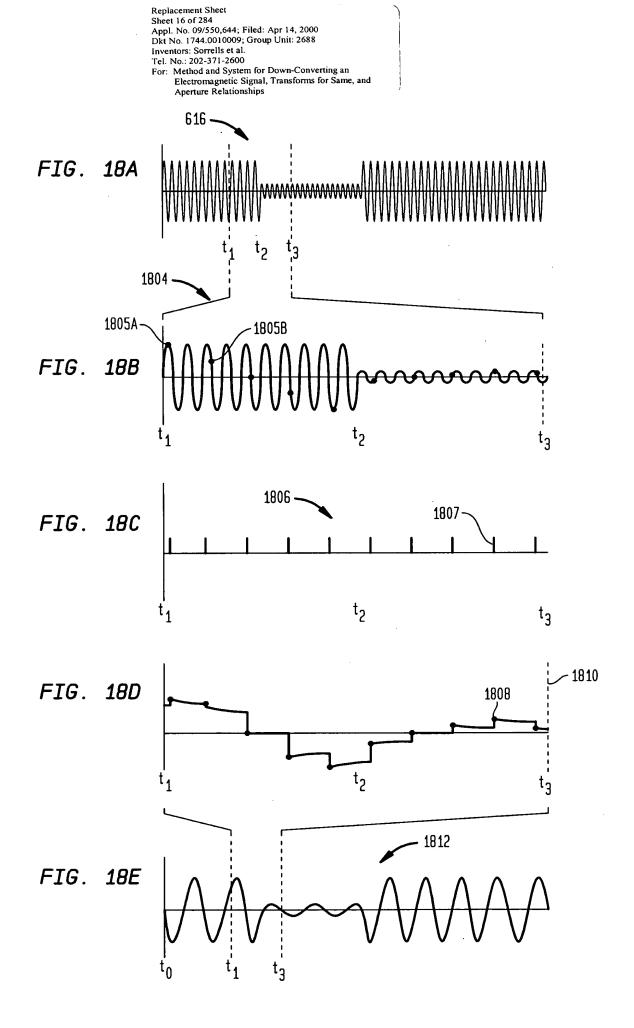


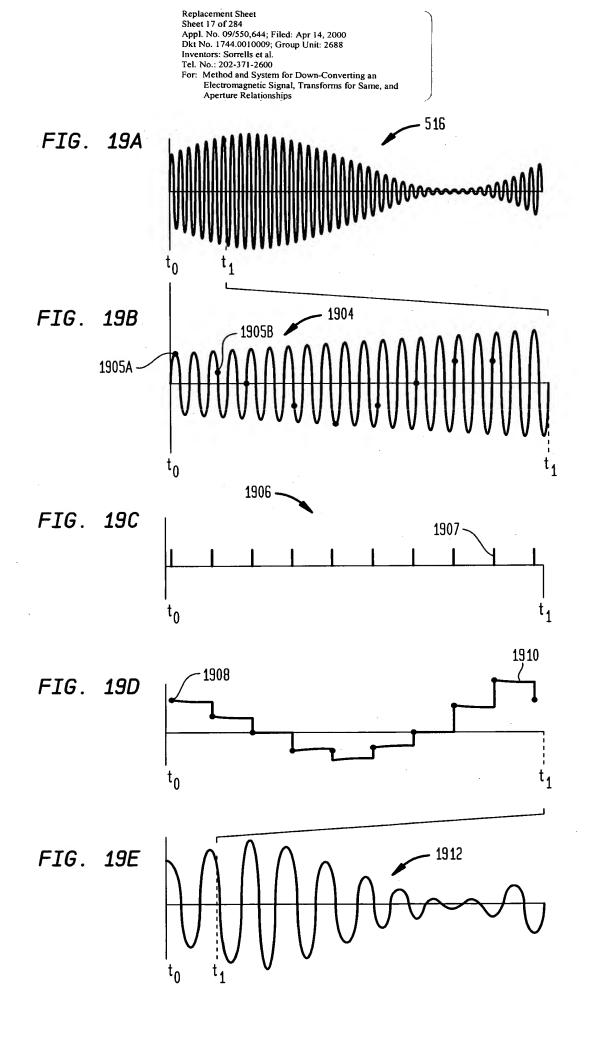
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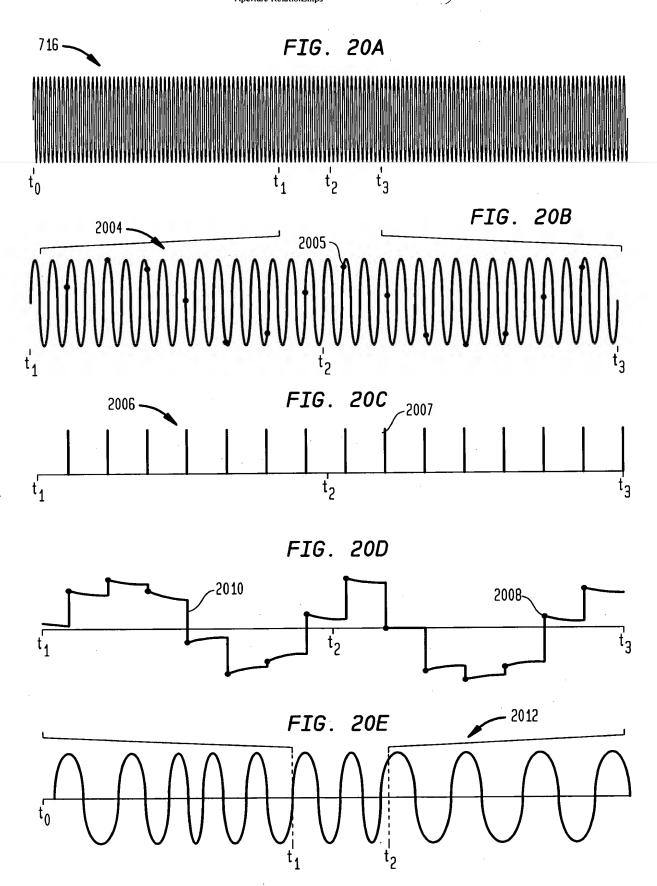




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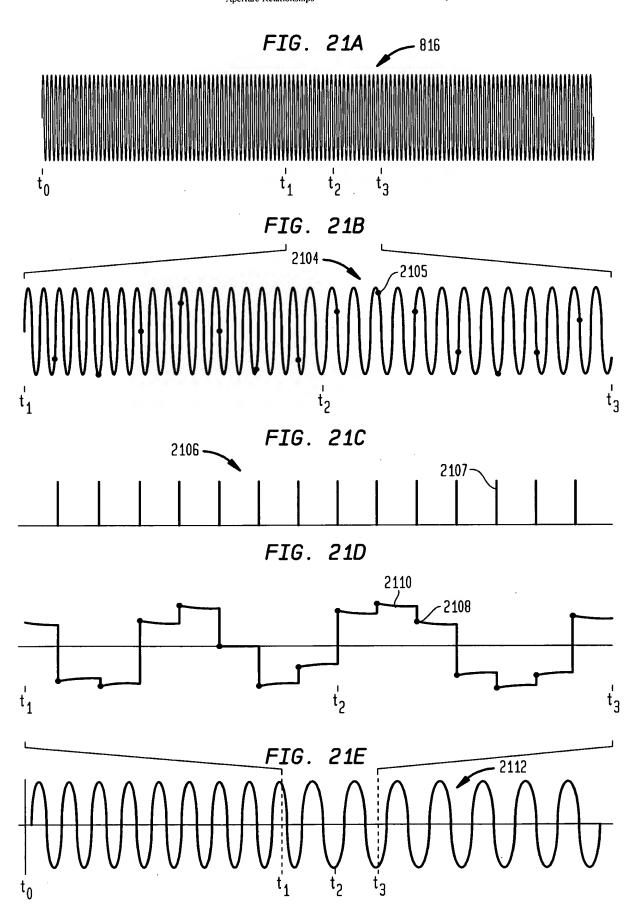
Tel. No.: 202-371-2600



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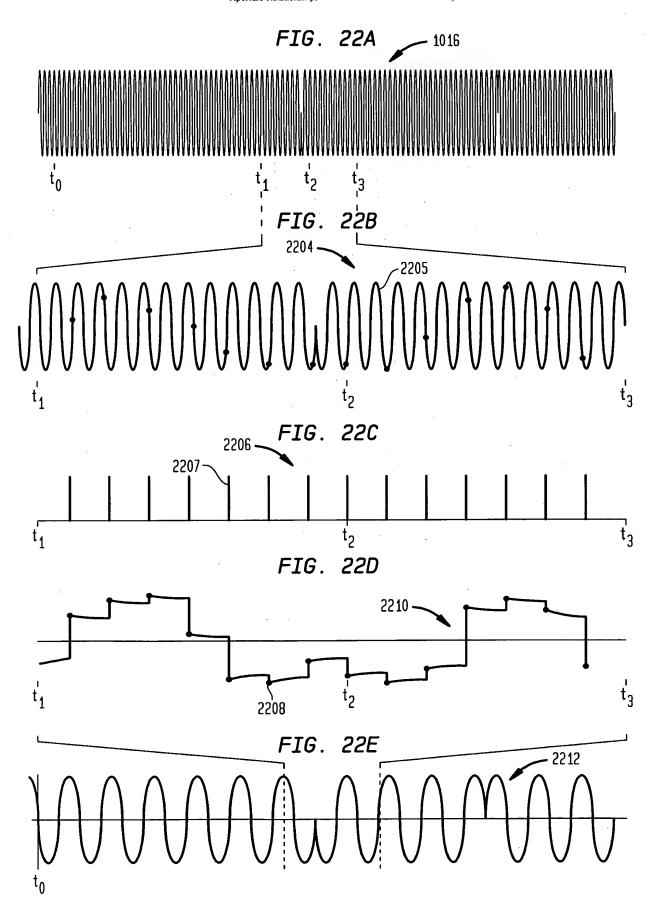
Appl. No. 09/550,644; Filed: Apr 14, 2000 Dkt No. 1744.0010009; Group Unit: 2688

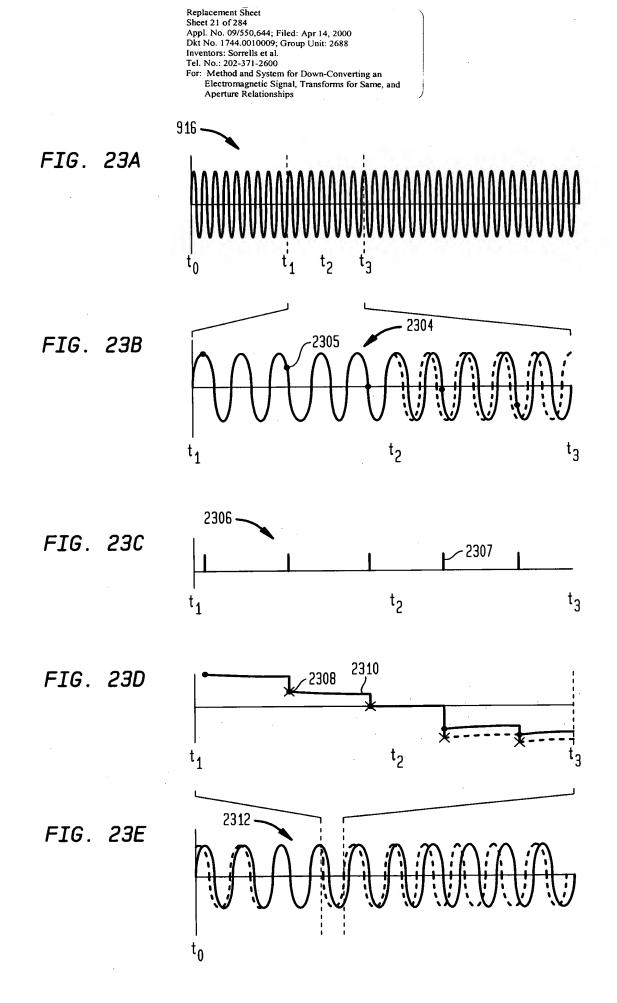
Inventors: Sorrells et al. Tel. No.: 202-371-2600



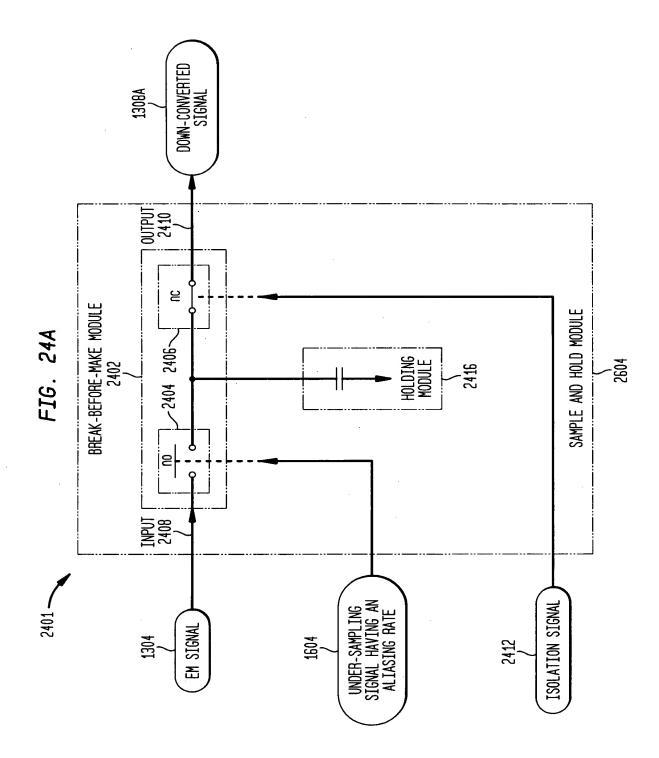
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FIG. 24B

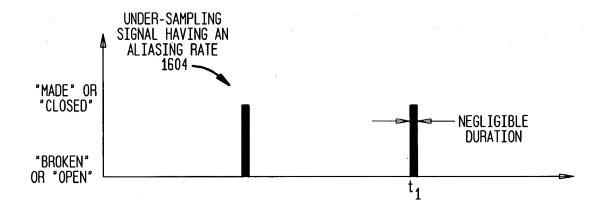
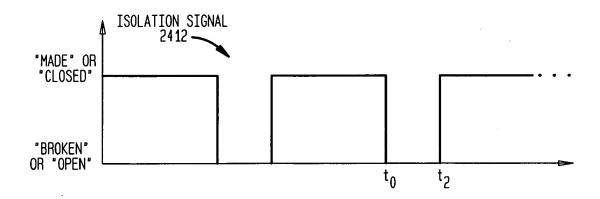
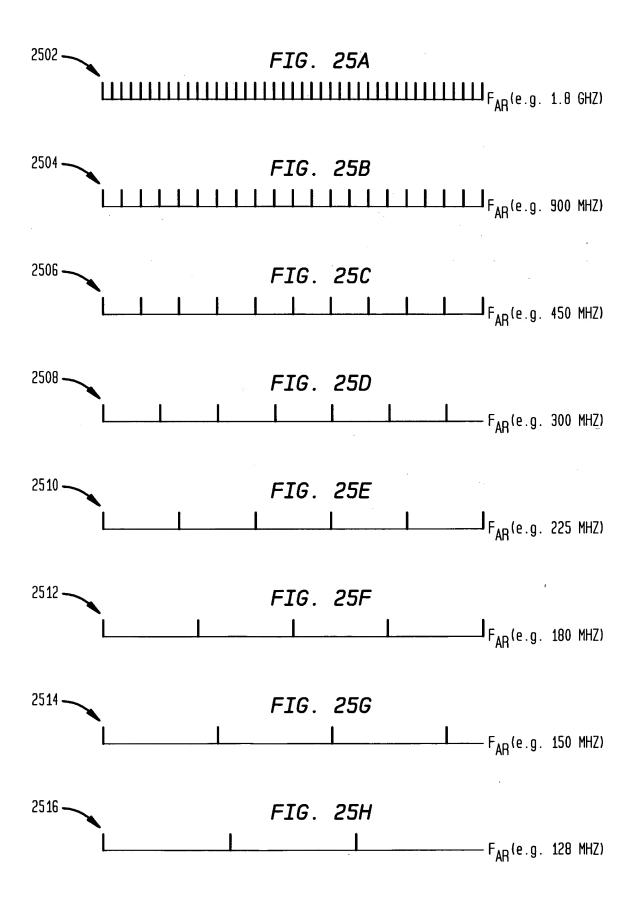


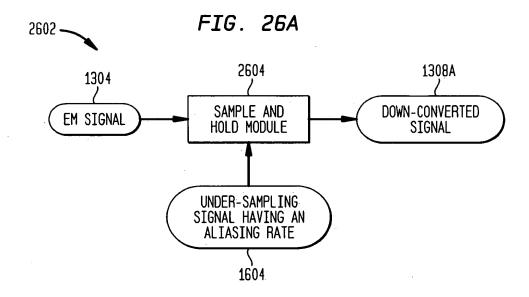
FIG. 24C

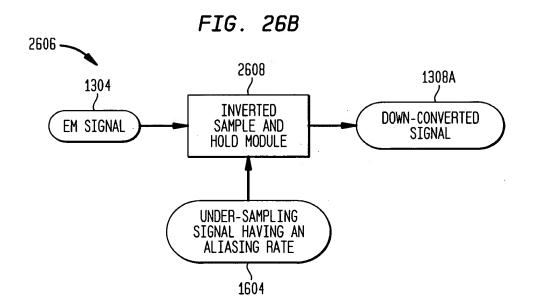


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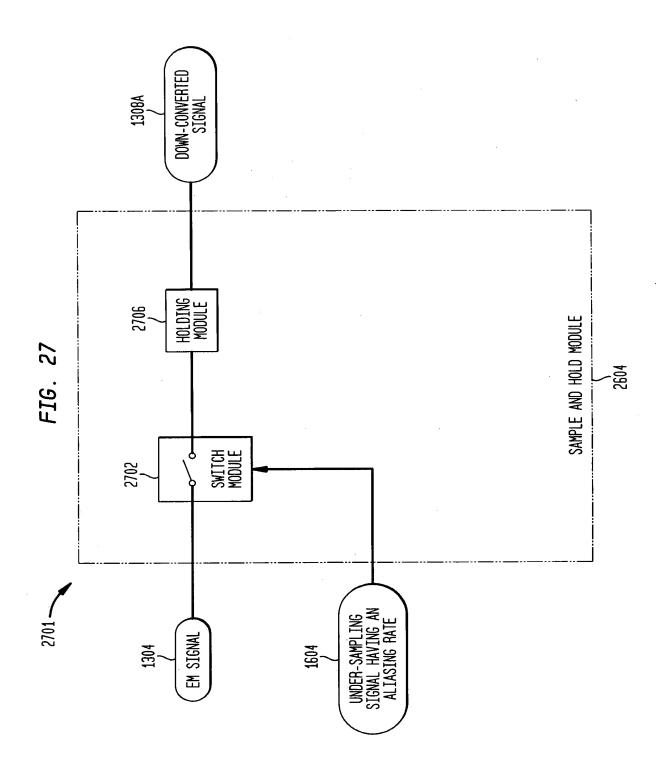


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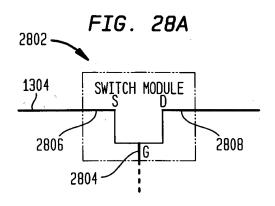


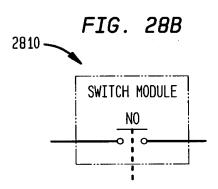
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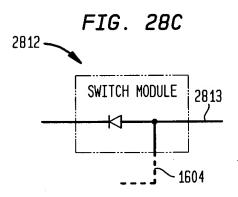


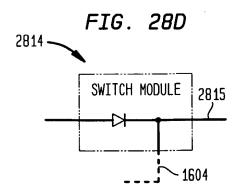
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FIG. 29A

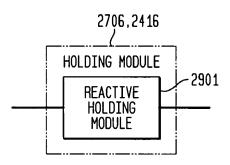
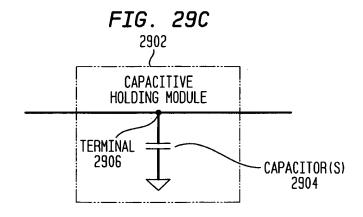


FIG. 29B 2706,2416 HOLDING MODULE -2901 REACTIVE HOLDING MODULE 2902 CAPACITIVE HOLDING MODULE



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FIG. 29D

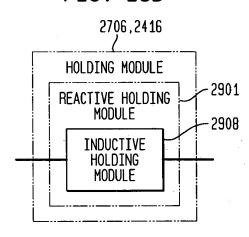


FIG. 29E

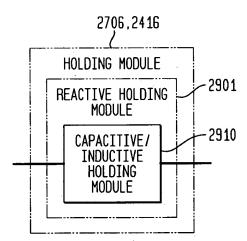
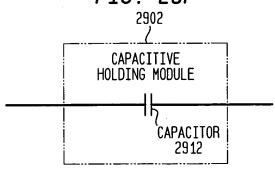
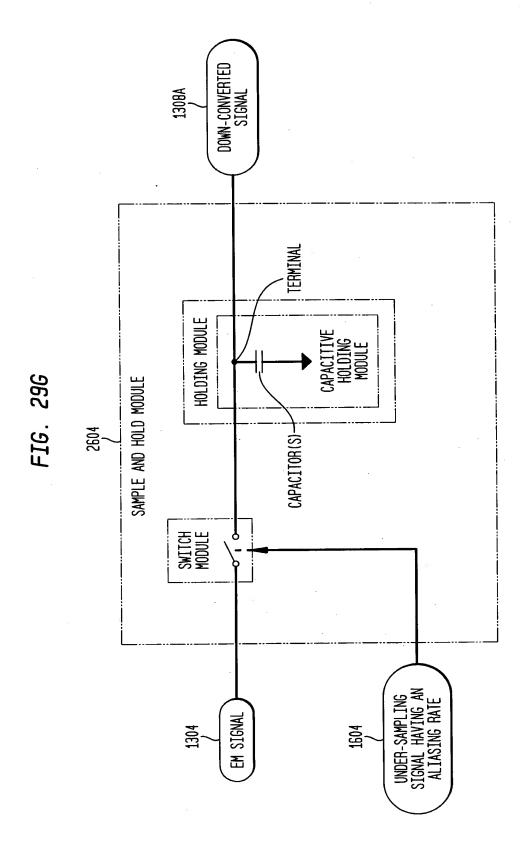


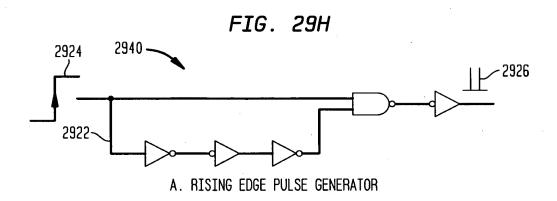
FIG. 29F

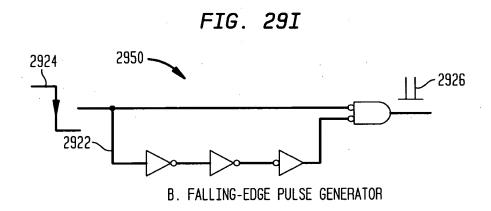


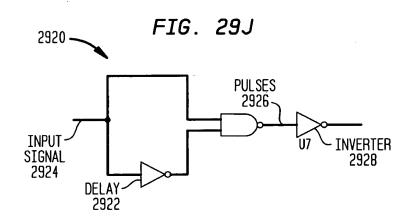
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FIG. 29K

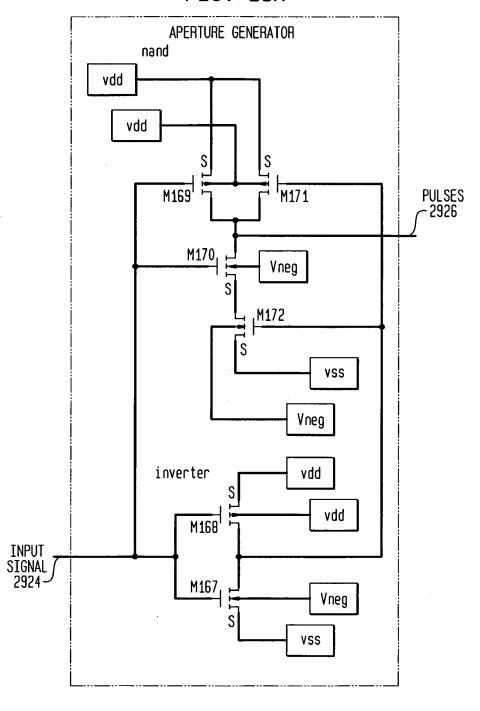
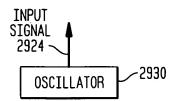


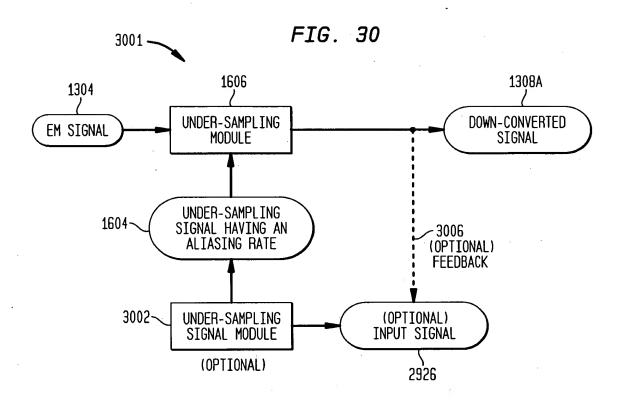
FIG. 29L



Replacement Sheet

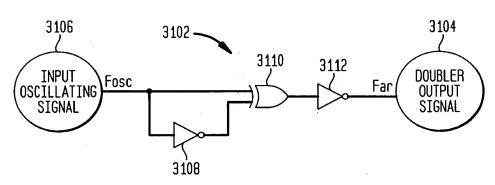
Replacement sheet
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Inventors: Sorrells et al.

Tel. No.: 202-371-2600

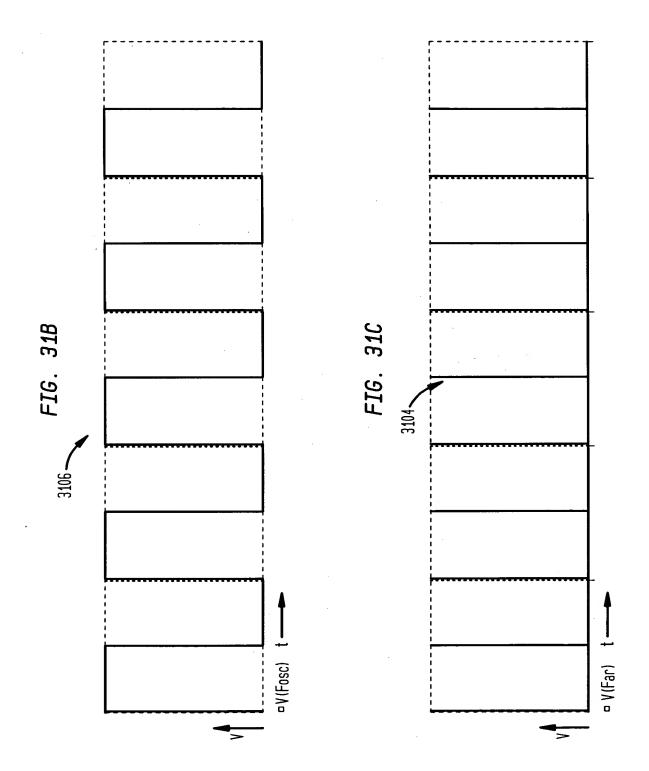


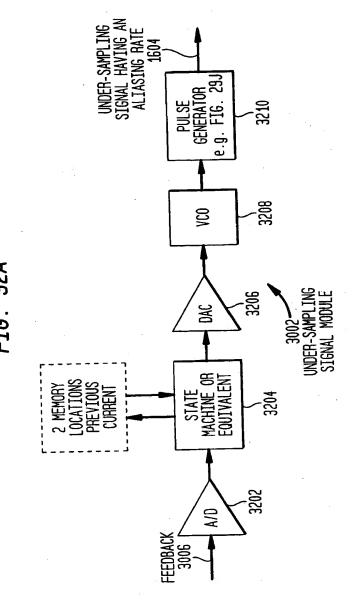
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FIG. 31A



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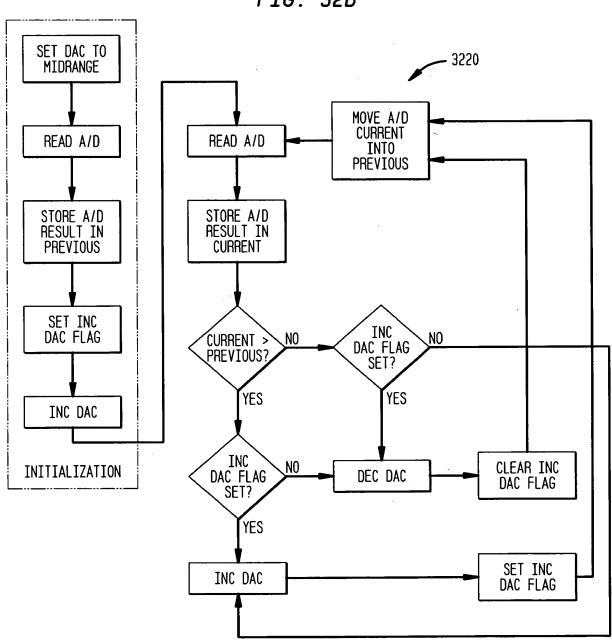




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Electromagnetic Signal, Transforms for Same, and Aperture Relationships

FIG. 32B

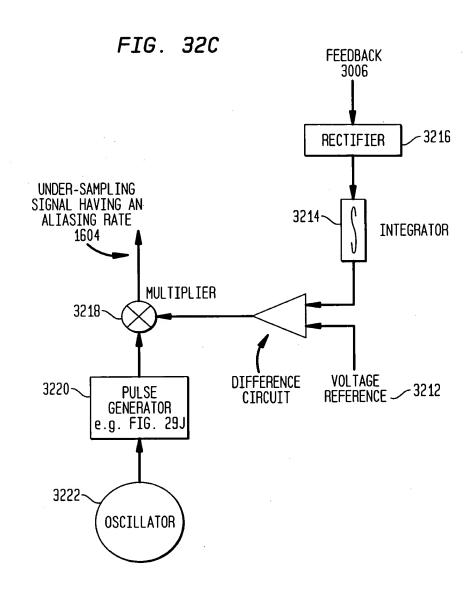


STATE MACHINE FLOWCHART

Replacement Sheet Sheet 38 of 284 Appl. No. 09/550,644; Filed: Apr 14, 2000 Dkt No. 1744.0010009; Group Unit: 2688

Inventors: Sorrells et al.

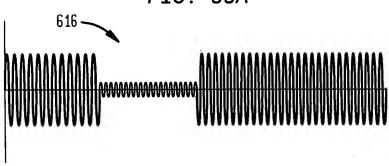
For: Method and System for Down-Converting an Electromagnetic Signal, Transforms for Same, and Aperture Relationships



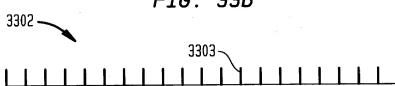
ENERGY TRANSFER SIGNAL MODULE 3002

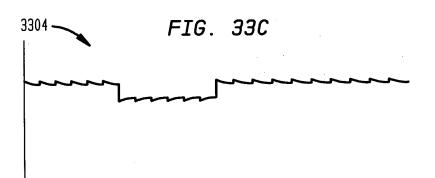
Replacement Sheet
Sheet 39 of 284
Appl. No. 09/550,644; Filed: Apr 14, 2000
Dkt No. 1744.0010009; Group Unit: 2688
Inventors: Sorrells et al.
Tel. No.: 202-371-2600
For: Method and System for Down-Converting an
Electromagnetic Signal, Transforms for Same, and
Aperture Relationships

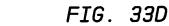


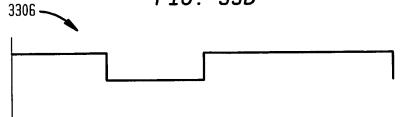


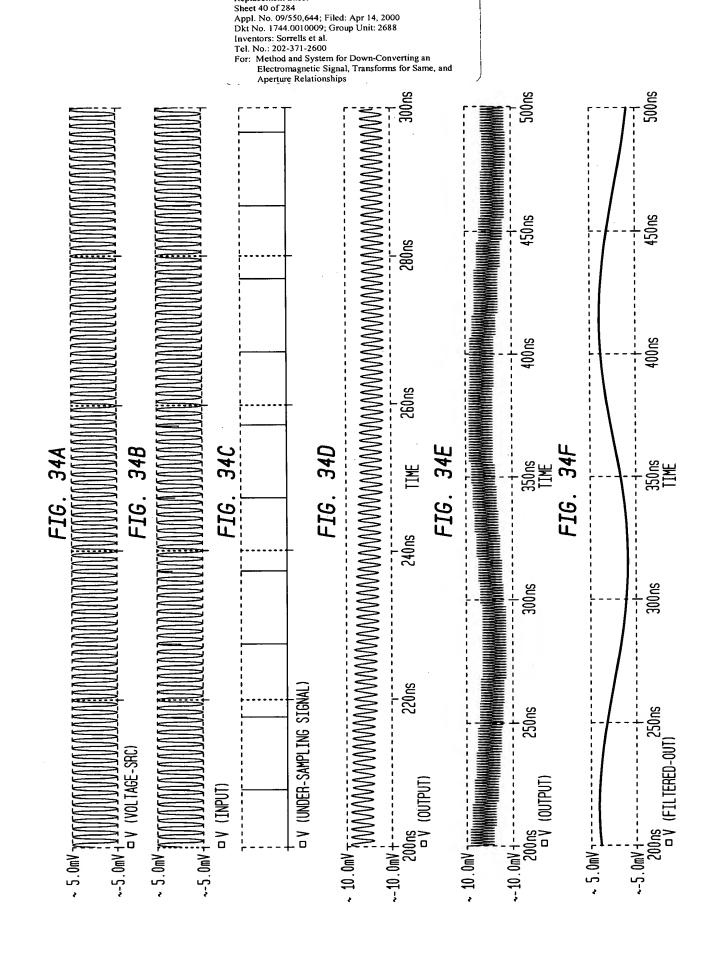
## FIG. 33B





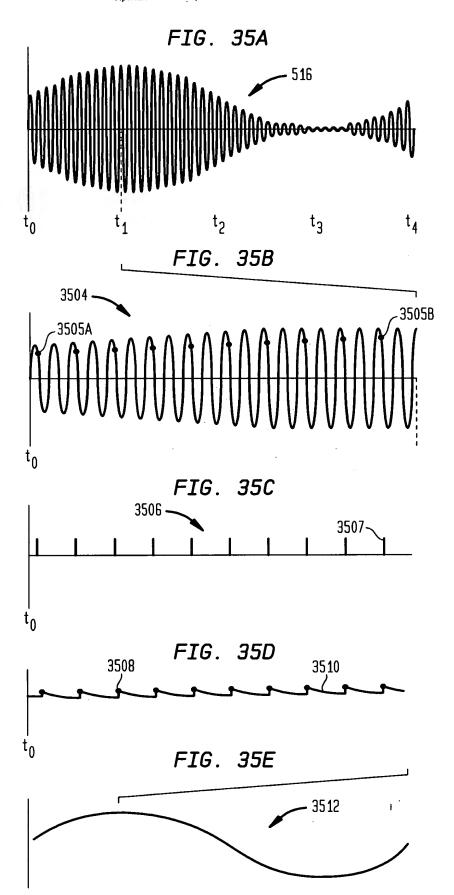




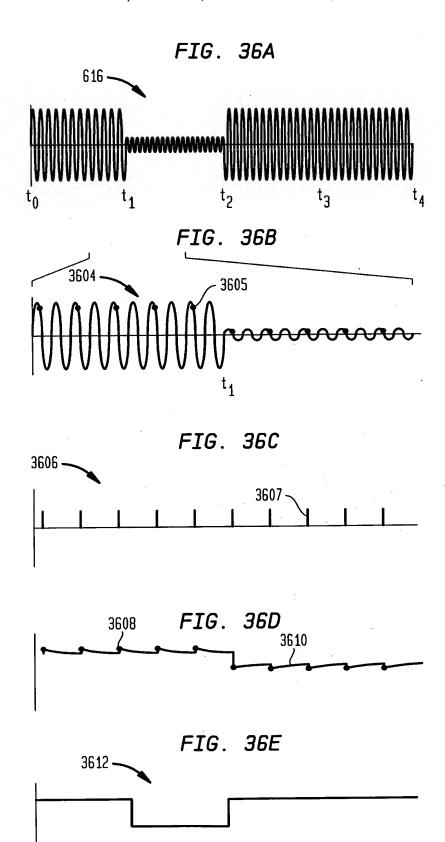


Replacement Sheet

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Dkt No. 1744.0010009; Group Unit: 2688
Inventors: Sorrells et al.
Tel. No.: 202-371-2600
For: Method and System for Down-Converting an
Electromagnetic Signal, Transforms for Same, and
Aperture Relationships

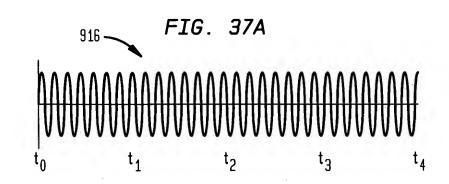


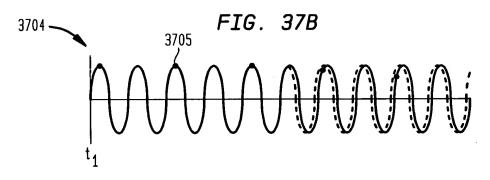
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Dkt No. 1744.0010009; Group Unit: 2688
Inventors: Sorrells et al.
Tel. No.: 202-371-2600
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Electromagnetic Signal, Transforms for Same, and
Aperture Relationships

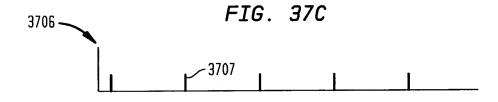


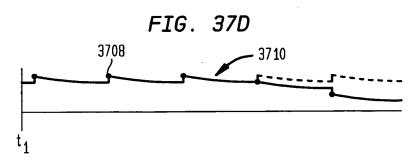
Replacement Sheet Sheet 43 of 284

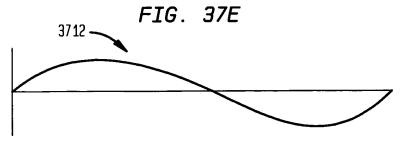
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Dkt No. 1744.0010009; Group Unit: 2688
Inventors: Sorrells et al.
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Aperture Relationships









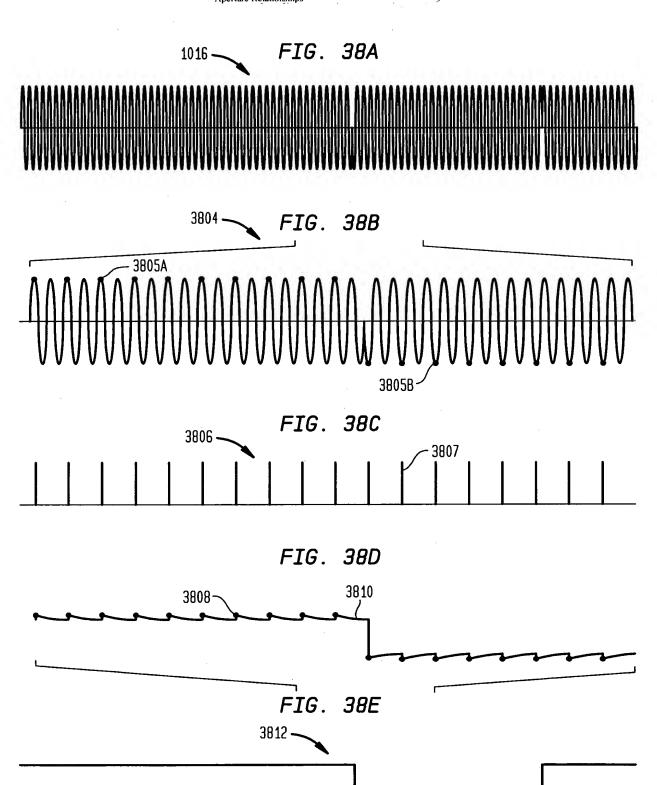


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Inventors: Sorrells et al.

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Dkt No. 1744.0010009; Group Unit: 2688
Inventors: Sorrells et al.
Tel. No.: 202-371-2600
For: Method and System for Down-Converting an

Electromagnetic Signal, Transforms for Same, and

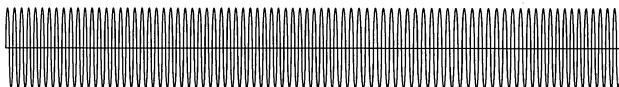
Aperture Relationships

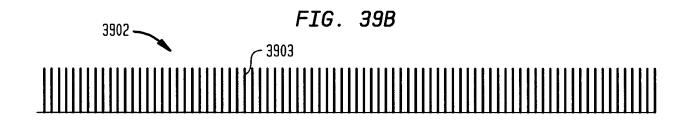


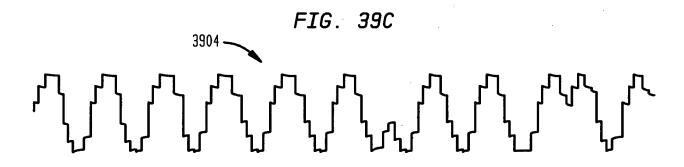
UPPER FREQ. 3910

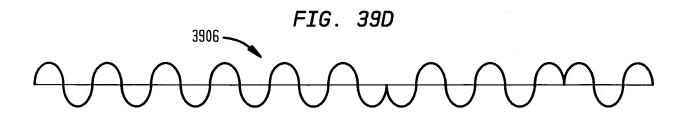
LOWER FREQ. 3912

UPPER FREQ. 3910







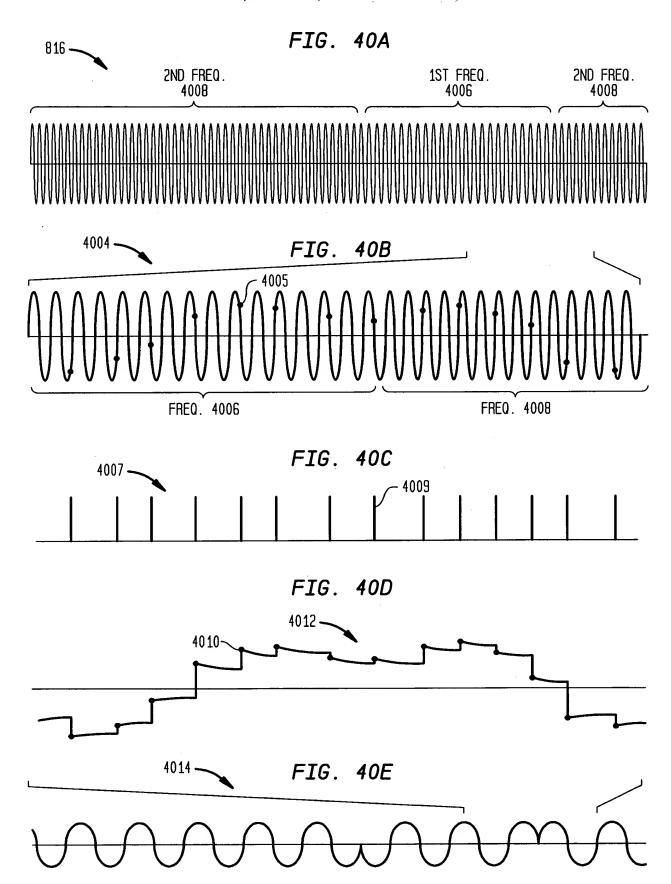


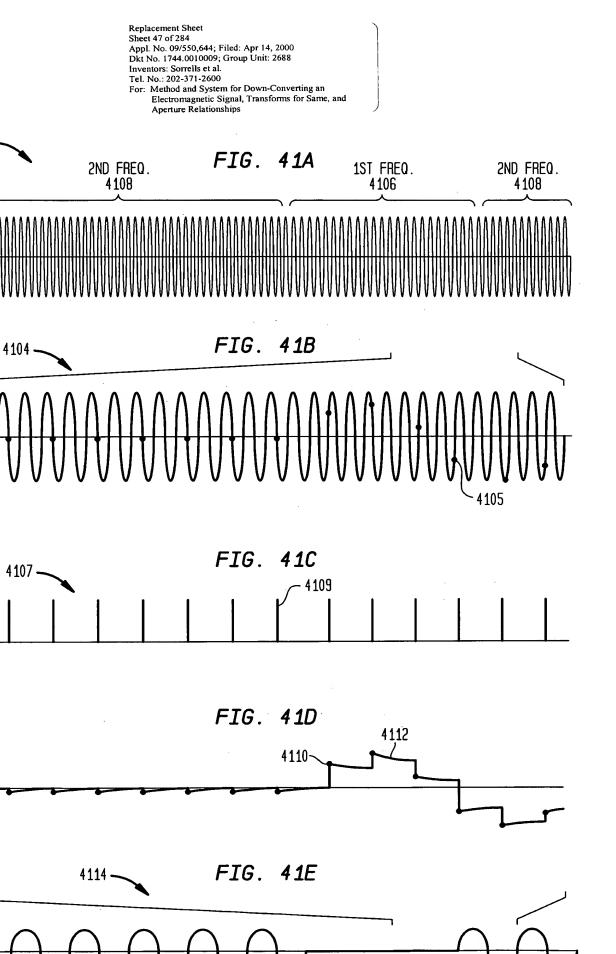
Replacement Sheet Sheet 46 of 284

Appl. No. 09/550,644; Filed: Apr 14, 2000 Dkt No. 1744.0010009; Group Unit: 2688

Inventors: Sorrells et al. Tel. No.: 202-371-2600

For: Method and System for Down-Converting an Electromagnetic Signal, Transforms for Same, and Aperture Relationships

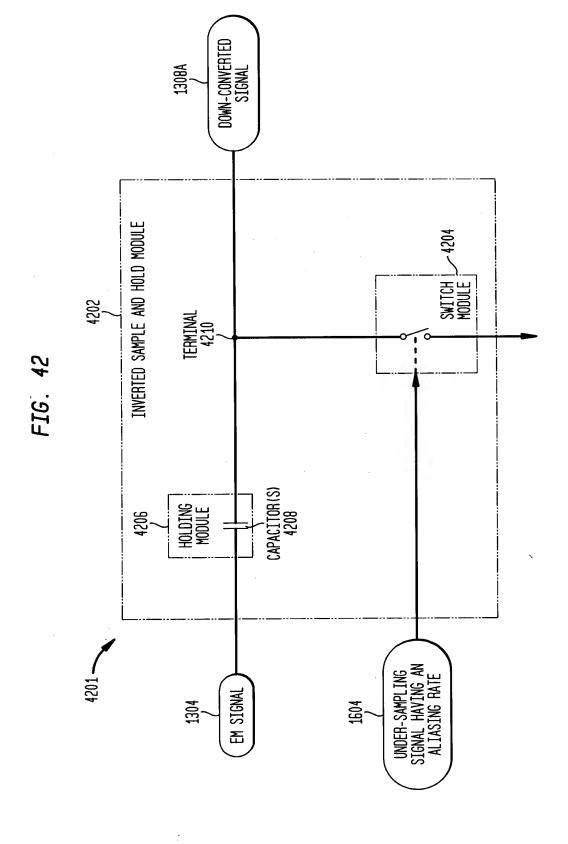




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Replacement Sheet Sheet 48 of 284 Appl. No. 09/550,644; Filed: Apr 14, 2000 Dkt No. 1744.0010009; Group Unit: 2688 Inventors: Sorrells et al. Tel. No.: 202-371-2600 For: Method and System for Down-Converting an

Electromagnetic Signal, Transforms for Same, and Aperture Relationships

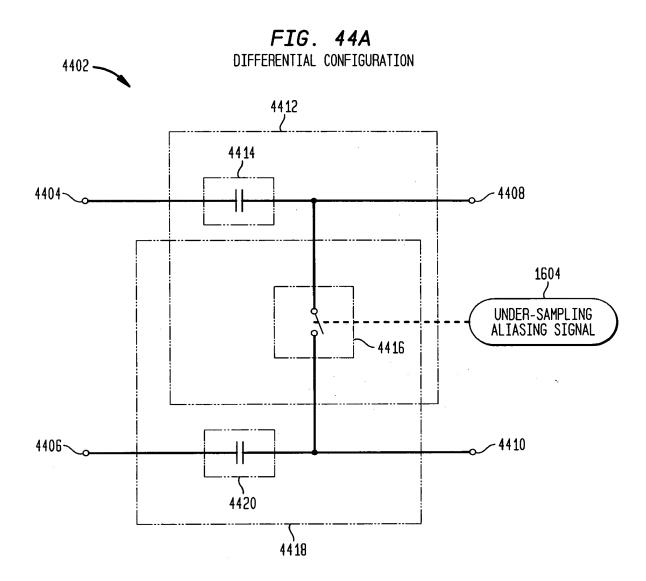


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Dkt No. 1744.0010009; Group Unit: 2688
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$$\Lambda q(t) = 2 \cdot C \cdot A \cdot \sin\left(\frac{1}{2} \cdot T\right) \cdot \cos\left(t - \frac{1}{2} \cdot T\right)$$

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Electromagnetic Signal, Transforms for Same, and
Aperture Relationships

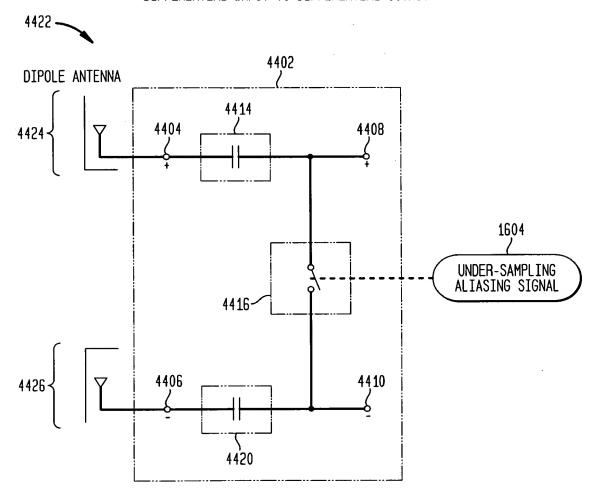


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Tel. No.: 202-371-2600

For: Method and System for Down-Converting an Electromagnetic Signal, Transforms for Same, and Aperture Relationships

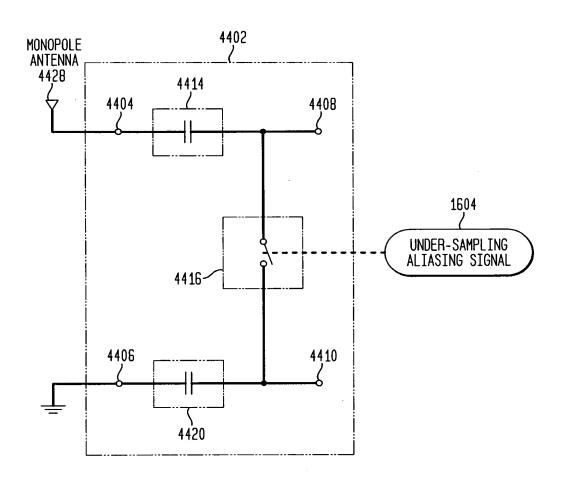
FIG. 44B DIFFERENTIAL INPUT TO DIFFERENTIAL OUTPUT



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Inventors: Sorrells et al.
Tel. No.: 202-371-2600
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For: Method and System for Down-Converting an Electromagnetic Signal, Transforms for Same, and Aperture Relationships

FIG. 44C SINGLE INPUT TO DIFFERENTIAL OUTPUT



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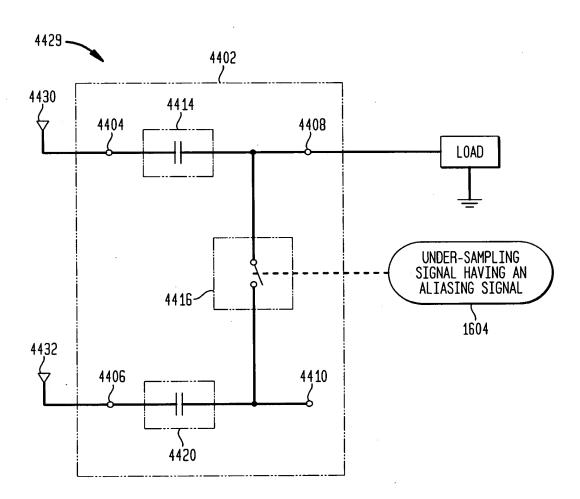
Dkt No. 1744.0010009; Group Unit: 2688

Inventors: Sorrells et al.

Tel. No.: 202-371-2600

For: Method and System for Down-Converting an Electromagnetic Signal, Transforms for Same, and Aperture Relationships

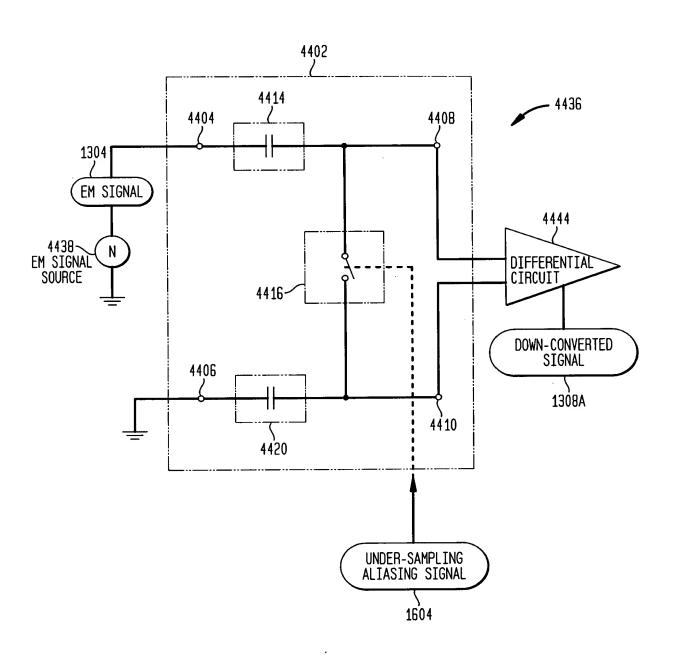
FIG. 44D DIFFERENTIAL INPUT TO SINGLE OUTPUT



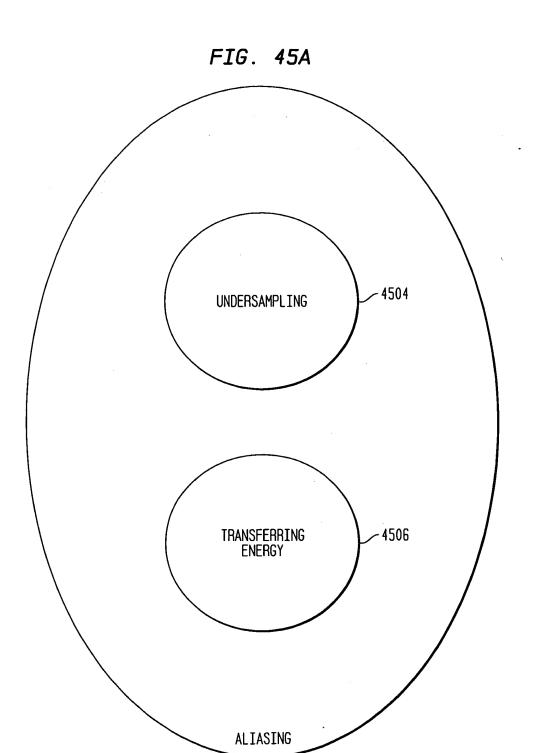
Replacement Sheet Sheet 54 of 284 Appl. No. 09/550,644; Filed: Apr 14, 2000 Dkt No. 1744.0010009; Group Unit: 2688

Dr. 1744.0010005; Group Gint. 2008
Inventors: Sorrells et al.
Tel. No.: 202-371-2600
For: Method and System for Down-Converting an Electromagnetic Signal, Transforms for Same, and Aperture Relationships

FIG. 44E EXAMPLE INPUT/OUTPUT CIRCUITRY

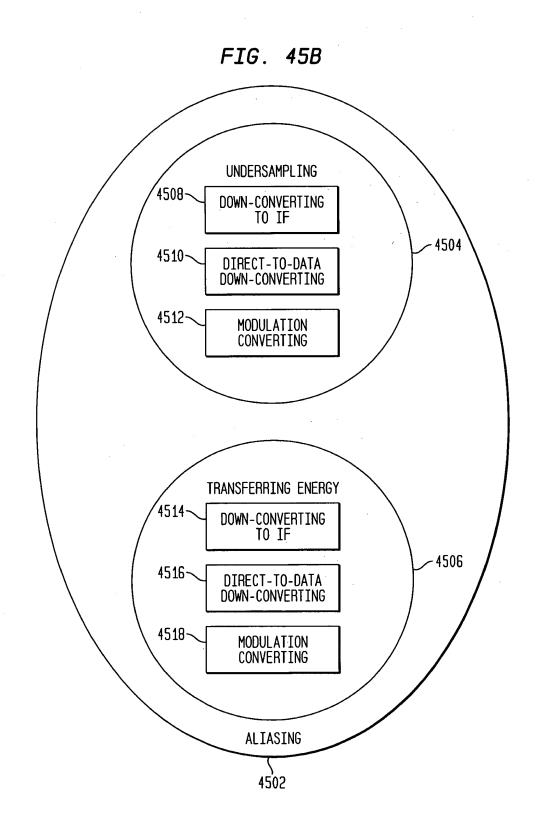


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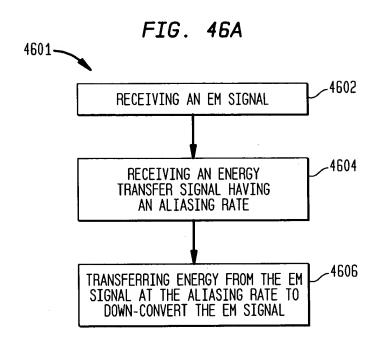
Replacement Sheet
Sheet 56 of 284
Appl. No. 09/550,644; Filed: Apr 14, 2000
Dkt No. 1744.0010009; Group Unit: 2688
Inventors: Sorrells et al.
Tel. No.: 202-371-2600
For: Method and System for Down-Converting an
Electromagnetic Signal, Transforms for Same, and
Aperture Relationships

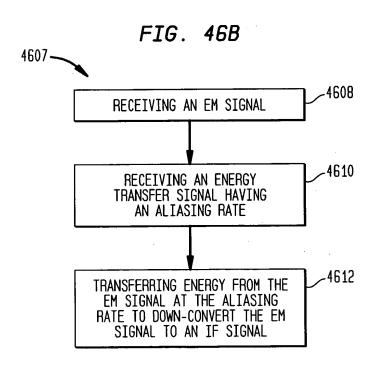


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Tel. No.: 202-371-2600

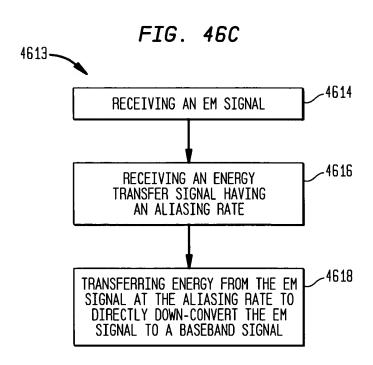
For: Method and System for Down-Converting an Electromagnetic Signal, Transforms for Same, and Aperture Relationships

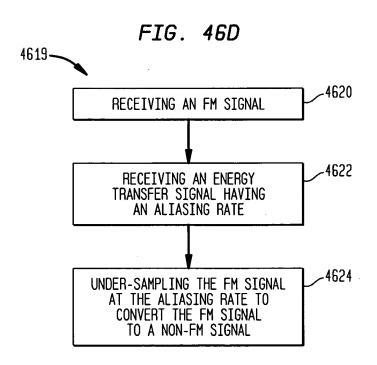




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Appl. No. 09/550,644; Filed: Apr 14, 2000
Dkt No. 1744.0010009; Group Unit: 2688
Inventors: Sorrells et al.
Tel. No.: 202-371-2600
For: Method and System for Down-Converting an
Electromagnetic Signal, Transforms for Same, and

Aperture Relationships



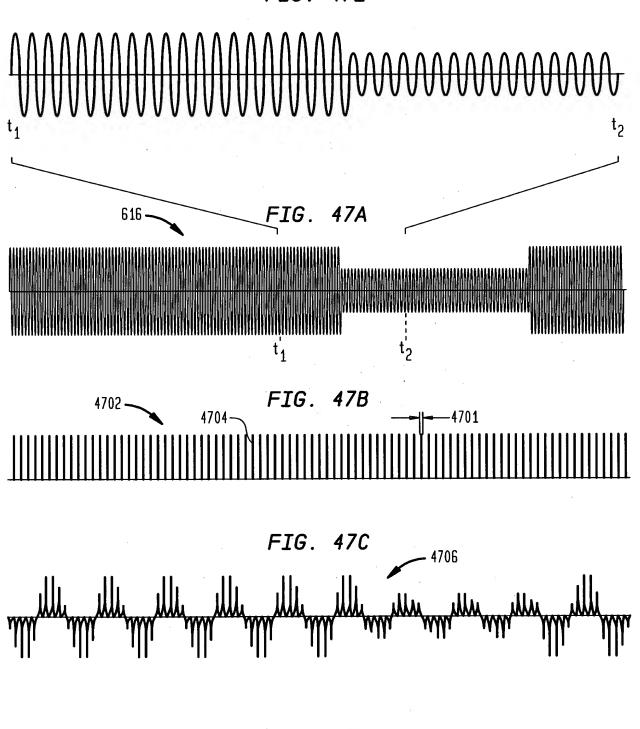


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Tel. No.: 202-371-2600

For: Method and System for Down-Converting an Electromagnetic Signal, Transforms for Same, and Aperture Relationships

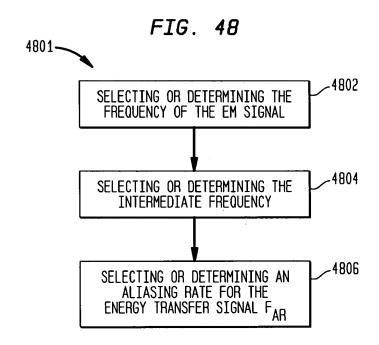
FIG. 47E



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Tel. No.: 202-371-2600

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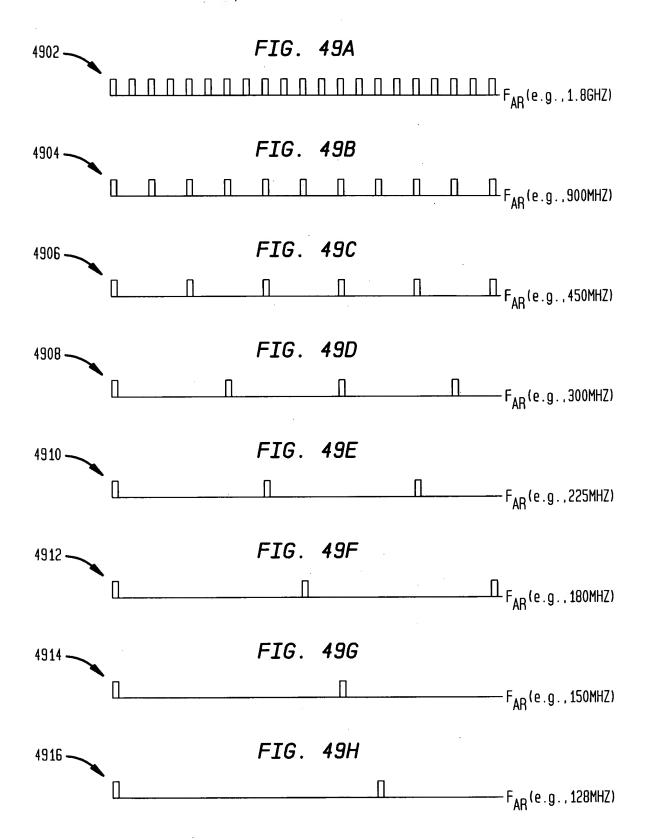
Replacement Sheet

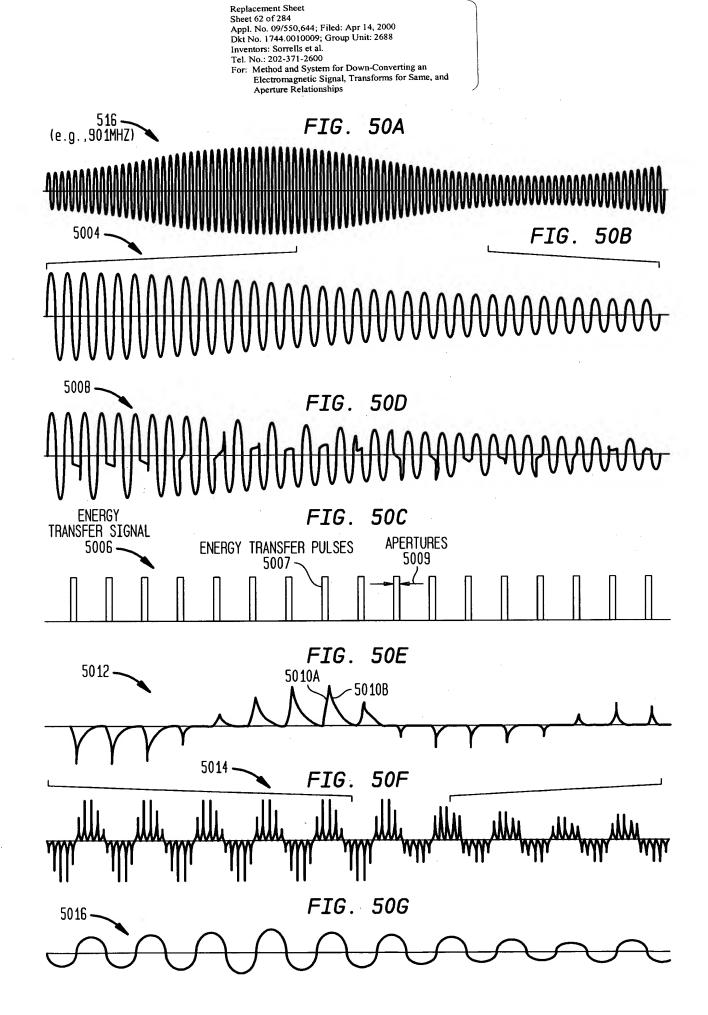
Sheet 61 of 284 Appl. No. 09/550,644; Filed: Apr 14, 2000 Dkt No. 1744.0010009; Group Unit: 2688

Inventors: Sorrells et al. Tel. No.: 202-371-2600

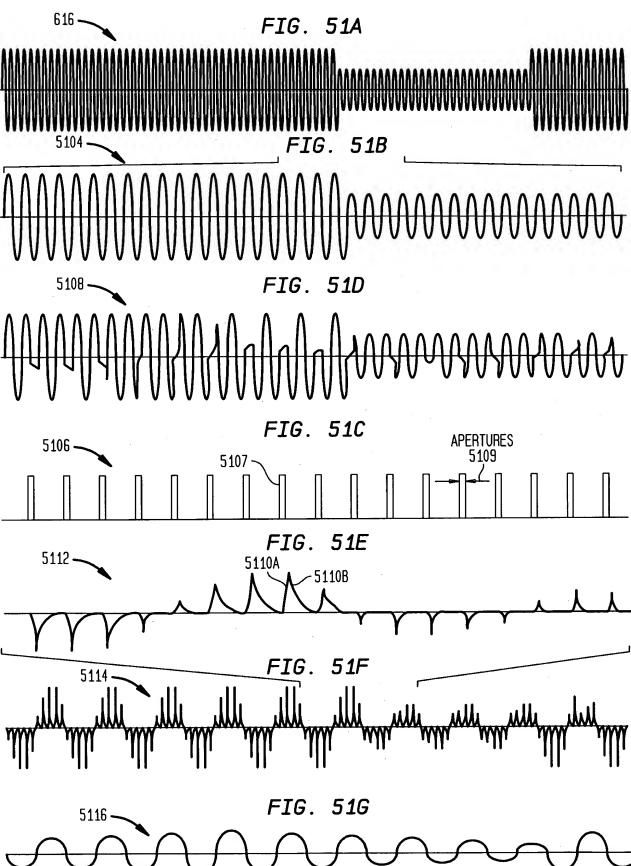
For: Method and System for Down-Converting an Electromagnetic Signal, Transforms for Same, and

Aperture Relationships





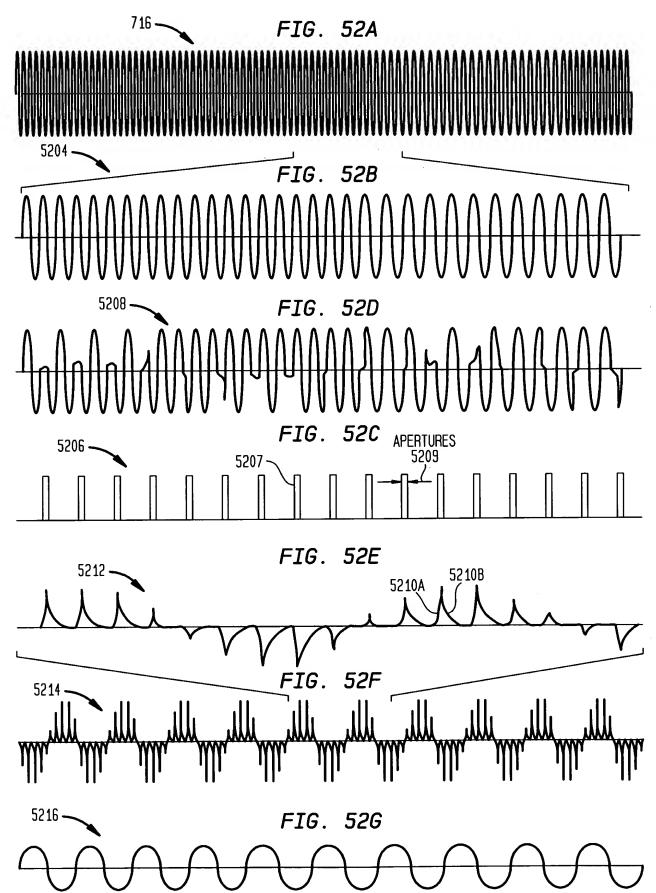
Replacement Sheet Sheet 63 of 284 Appl. No. 09/550,644; Filed: Apr 14, 2000 Dkt No. 1744.0010009; Group Unit: 2688 Inventors: Sorrells et al. Tel. No.: 202-371-2600 For: Method and System for Down-Converting an Electromagnetic Signal, Transforms for Same, and Aperture Relationships FIG. 51A FIG. 51B FIG. 51D FIG. 51C **APERTURES** 5109 5107 FIG. 51E 5110A -5110B 51F FIG.



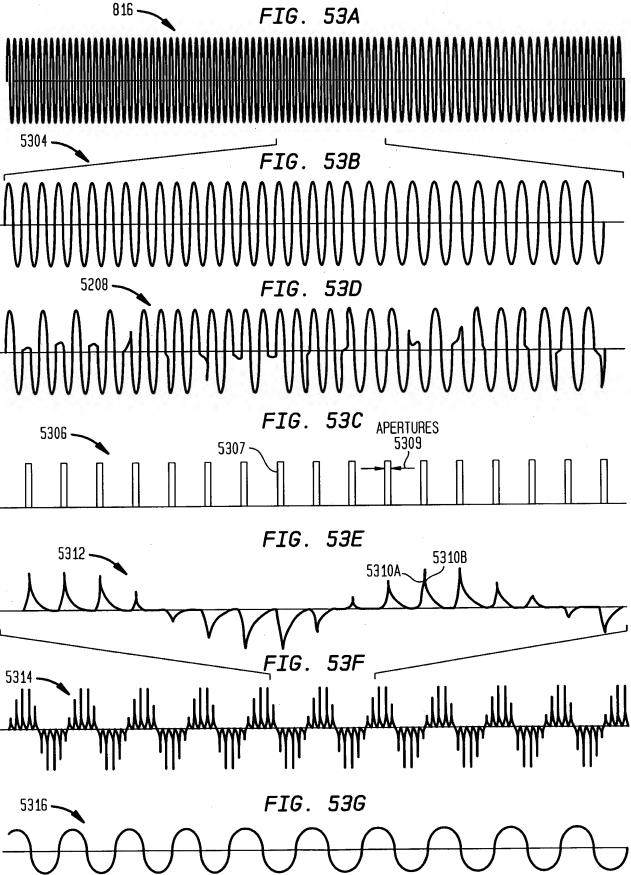
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Inventors: Sorrells et al.
Tel. No.: 202-371-2600
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or: Method and System for Down-Converting an
Electromagnetic Signal, Transforms for Same, and

Aperture Relationships

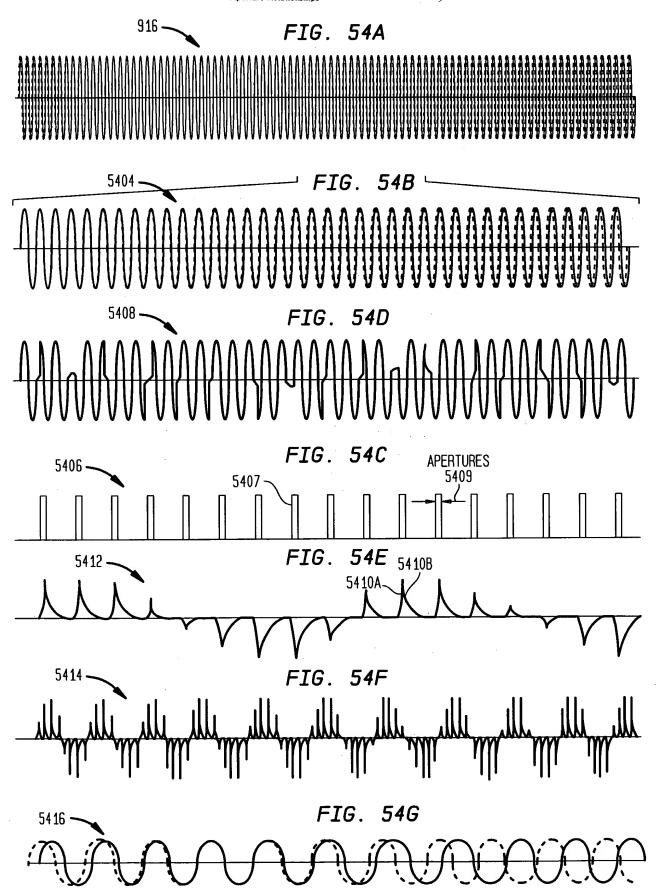


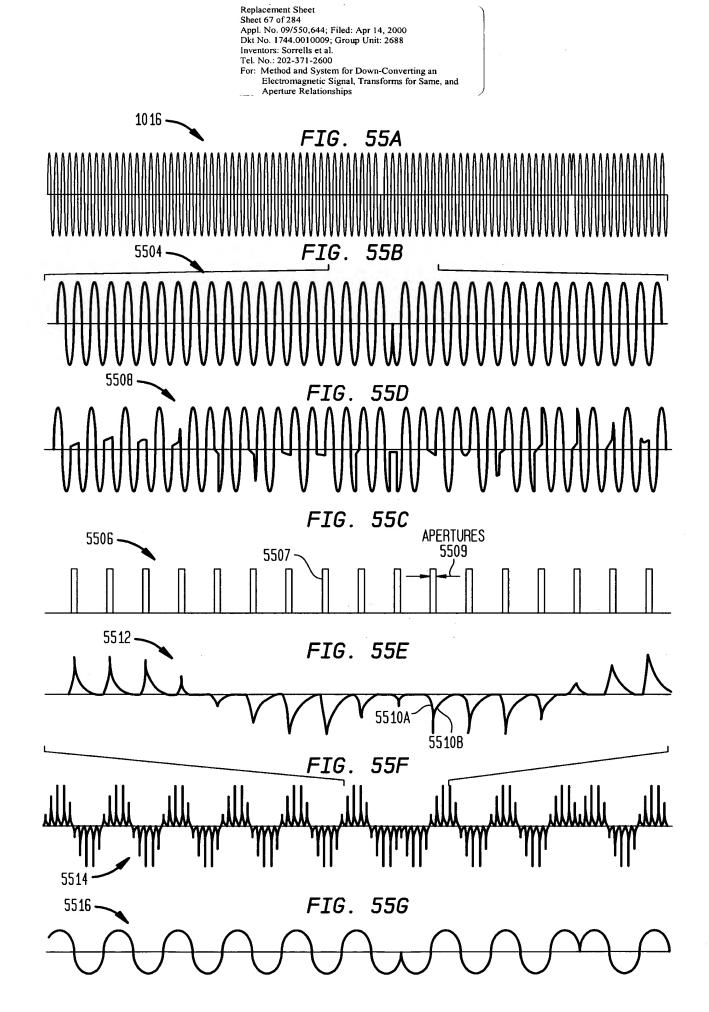
Replacement Sheet Sheet 65 of 284 Appl. No. 09/550,644; Filed: Apr 14, 2000 Dkt No. 1744.0010009; Group Unit: 2688 Inventors: Sorrells et al. Tel. No.: 202-371-2600 For: Method and System for Down-Converting an Electromagnetic Signal, Transforms for Same, and Aperture Relationships FIG. 53A FIG. 53B 53D FIG. FIG. 53C APERTURES 5309 5307 53E FIG. 5310B 5310A FIG. 53F



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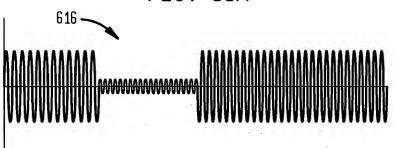


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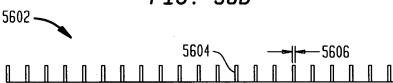
Replacement sheet
Sheet 68 of 284
Appl. No. 09/550,644; Filed: Apr 14, 2000
Dkt No. 1744.0010009; Group Unit: 2688
Inventors: Sorrells et al.
Tel. No.: 202-371-2600

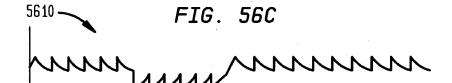
For: Method and System for Down-Converting an Electromagnetic Signal, Transforms for Same, and Aperture Relationships

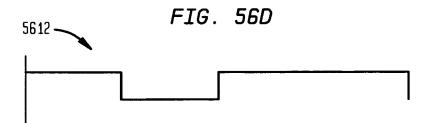




## FIG. 56B







Electromagnetic Signal, Transforms for Same, and Aperture Relationships FIG. 57A 516 (e.g., 900MHZ) 5704 FIG. 57B FIG. 57D 5708 -57C FIG. ENERGY TRANSFER SIGNAL **ENERGY TRANSFER** 5706 **APERTURES PULSES** 5709 5707 FIG. 57E 5712 -5710A--5710B 5716 -FIG. 57F

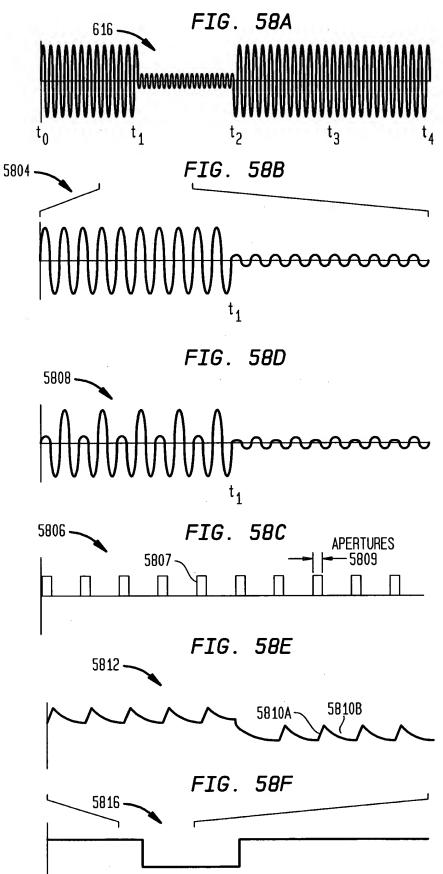
Replacement Sheet

Inventors: Sorrells et al. Tel. No.: 202-371-2600

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Inventors: Sorrells et al.
Tel. No.: 202-371-2600
For: Method and System for Down-Converting an
Electromagnetic Signal, Transforms for Same, and
Aperture Relationships FIG. 59A 916 t2 5904 -FIG. 59B FIG. 59D 5908 5906 -FIG. 59C **APERTURES** -5909 **~** 5907 FIG. 59E 5912 ~ 5910A 5910B FIG. 59F 5916

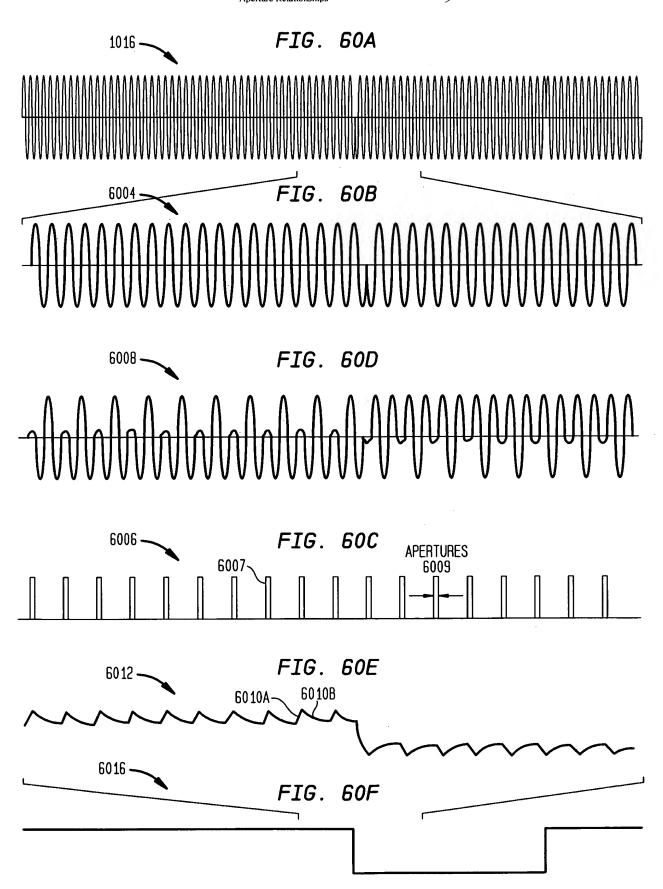
Replacement Sheet Sheet 72 of 284 Appl. No. 09/550,644; Filed: Apr 14, 2000 Dkt No. 1744.0010009; Group Unit: 2688 Inventors: Sorrells et al.

Trel. No. 1744.001003, droup Omi. 2008

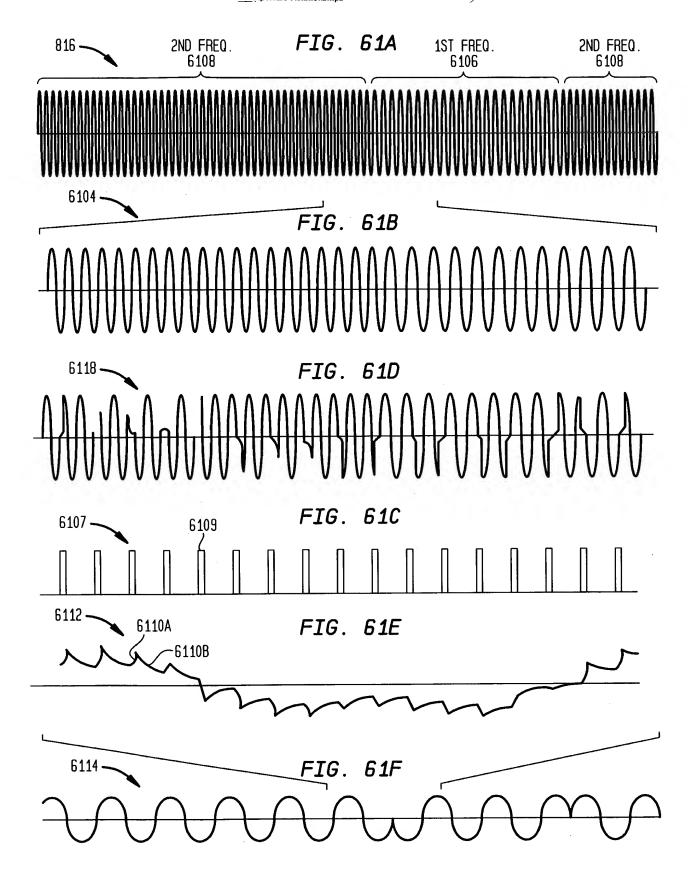
Inventors: Sorrells et al.

Tel. No.: 202-371-2600

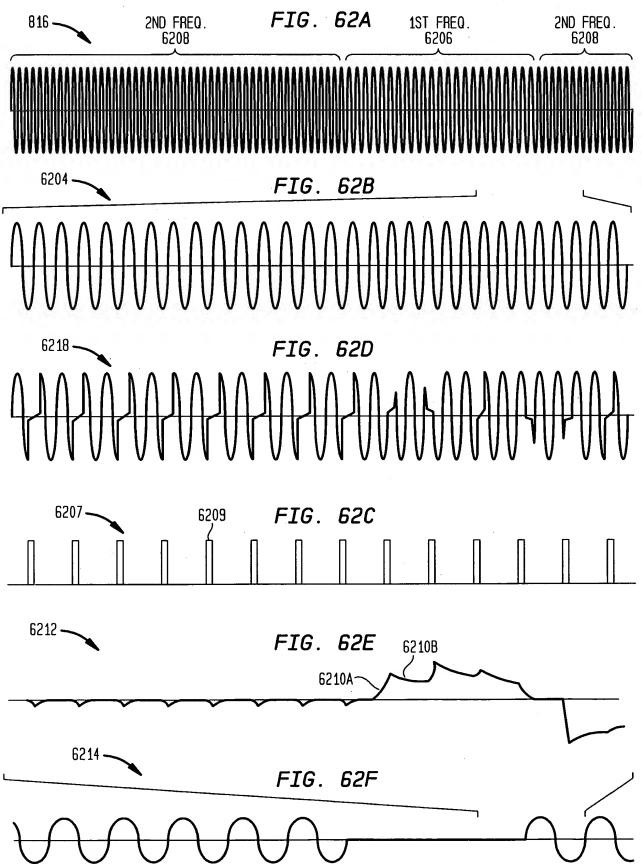
For: Method and System for Down-Converting an Electromagnetic Signal, Transforms for Same, and Aperture Relationships



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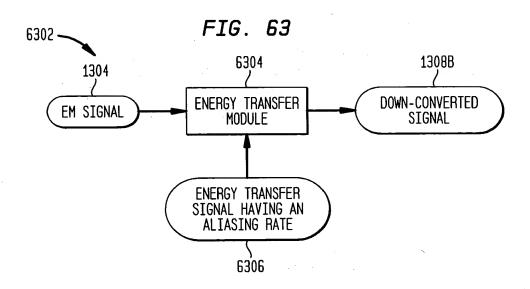


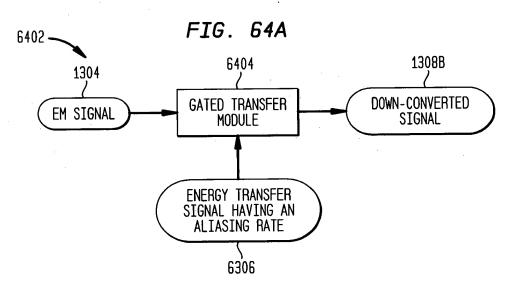
Replacement Sheet
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Inventors: Sorrells et al.
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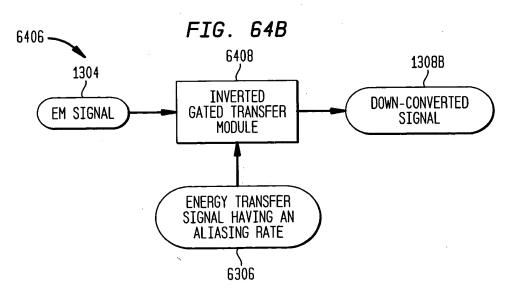


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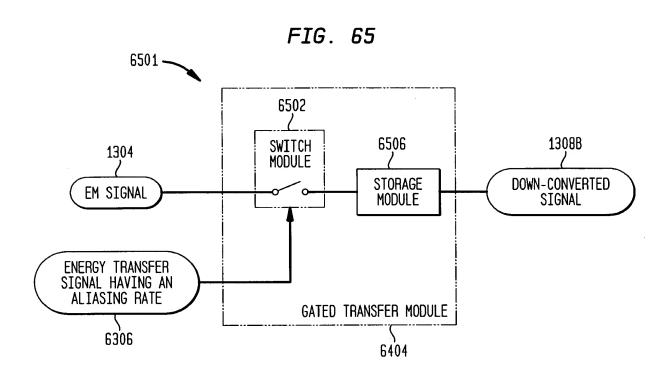


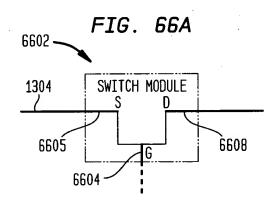


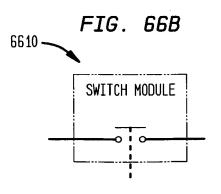
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Inventors: Sorrells et al. Tel. No.: 202-371-2600

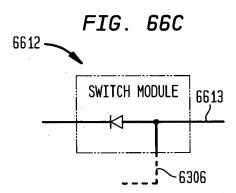


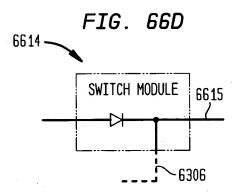




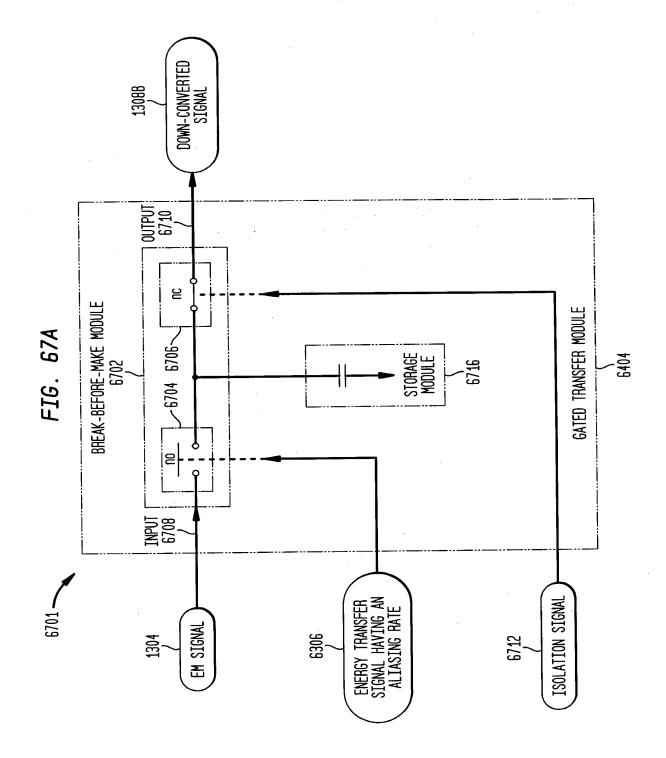
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Tel. No.: 202-371-2600

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Aperture Relationships

FIG. 67B

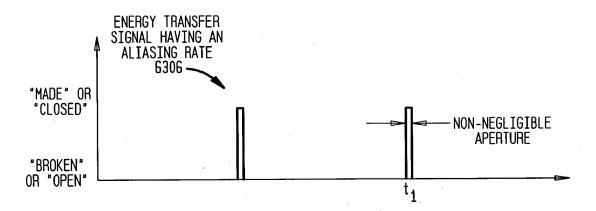
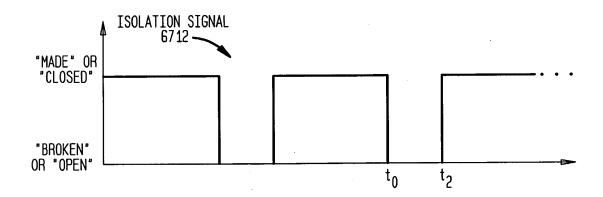


FIG. 67C



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FIG. 68A

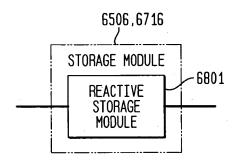


FIG. 68B

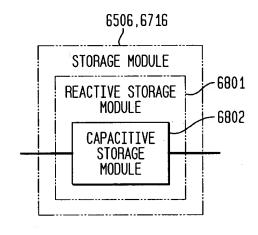
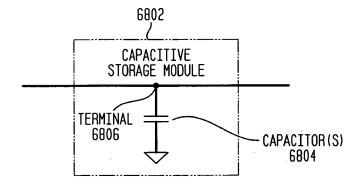
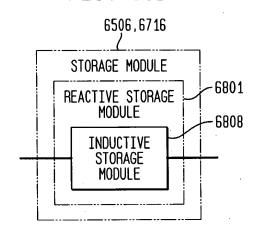


FIG. 68C



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## FIG. 68D



## FIG. 68E

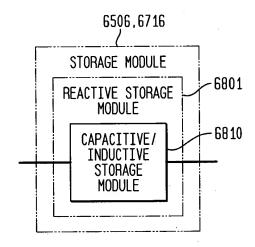
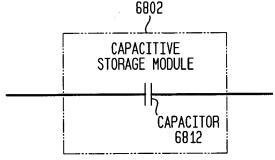
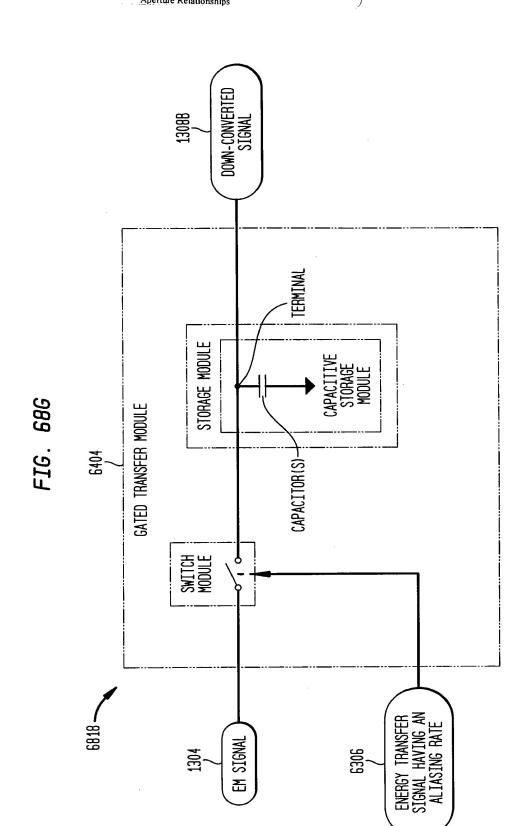


FIG. 68F



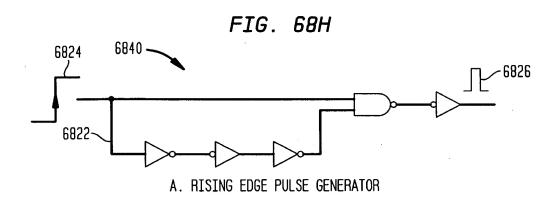
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Inventors: Sorrells et al.
Tel. No.: 202-371-2600

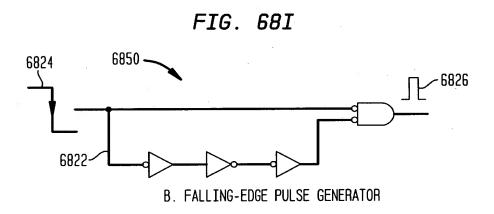


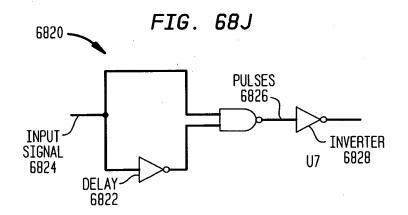
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FIG. 68K

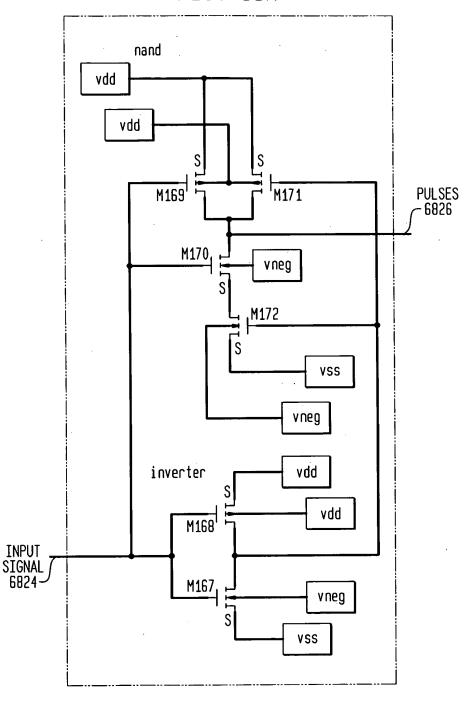
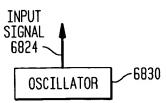
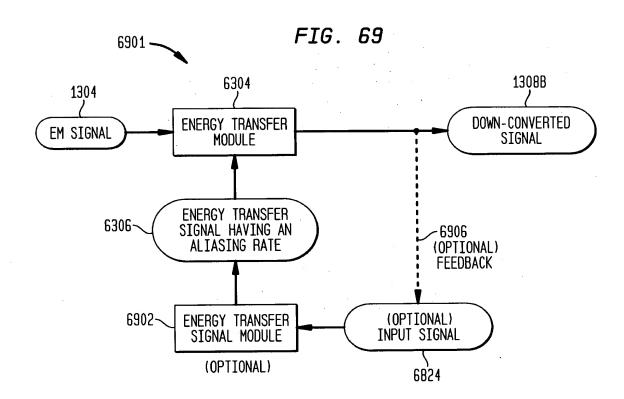


FIG. 68L



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FIG. 70 IMPEDANCE MATCHED ALIASING MODULE

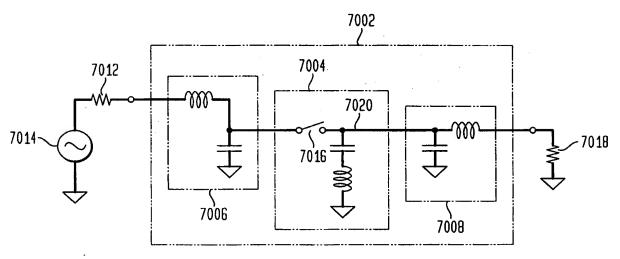
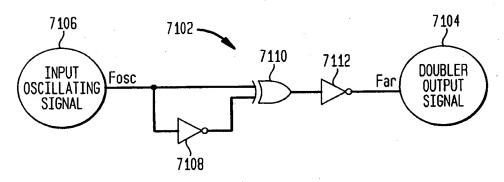
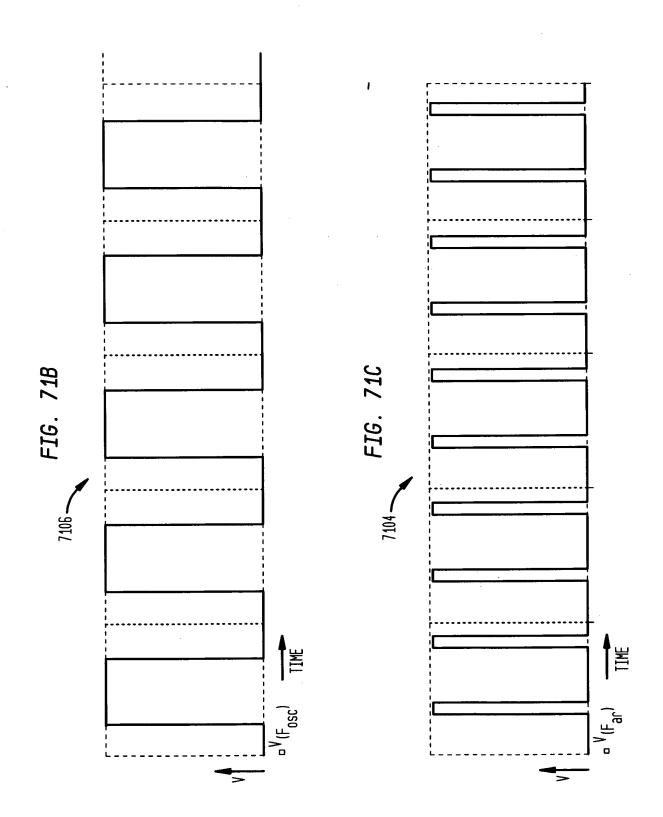


FIG. 71A

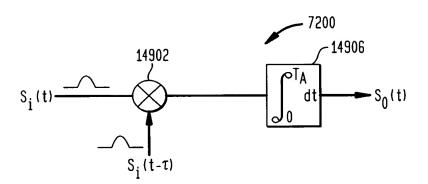


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FIG. 72



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FIG. 73
ALIASING MODULE

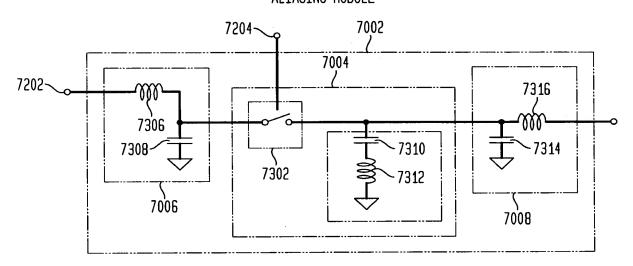
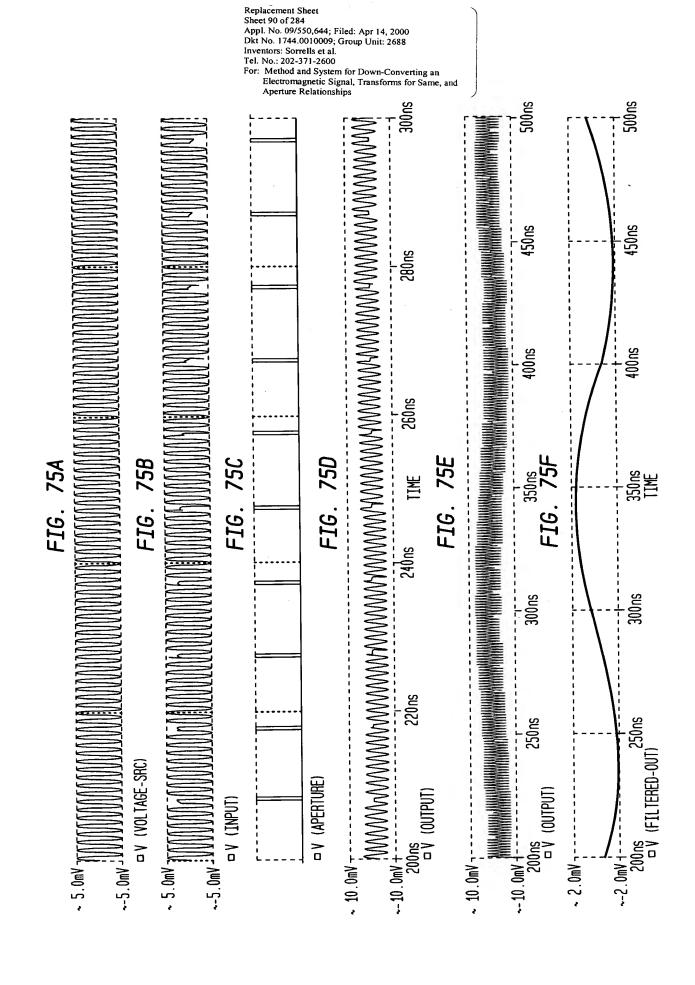
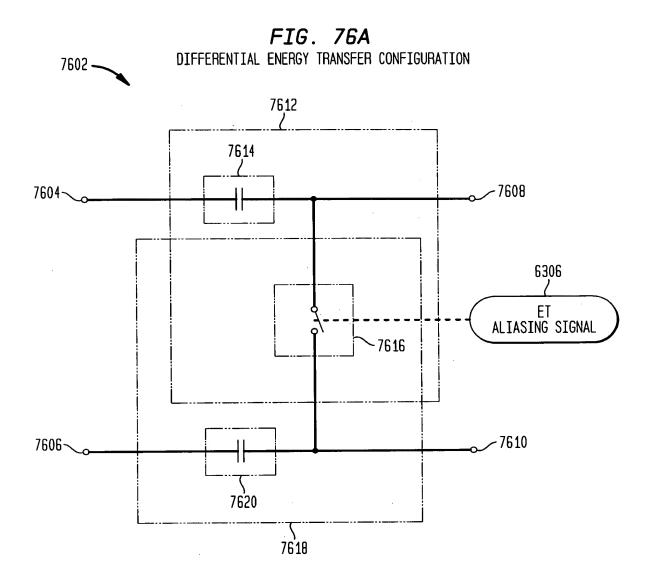


FIG. 74 6408 7401 -INVERTED GATE TRANSFER MODULE 7406 1308B **STORAGE** TERMINAL 1304 MODULE 7410 DOWN-CONVERTED SIGNAL EM SIGNAL 7408 CAPACITOR(S) ENERGY TRANSFER SIGNAL HAVING AN ALIASING RATE SWITCH MODULE 6306 7404



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FIG. 76B
DIFFERENTIAL INPUT TO DIFFERENTIAL OUTPUT

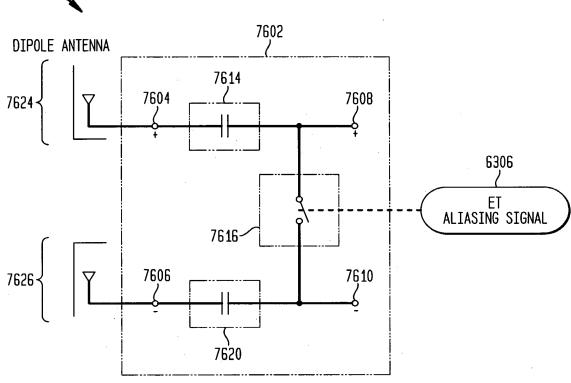
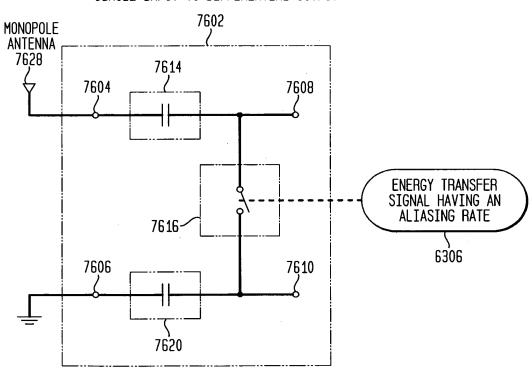
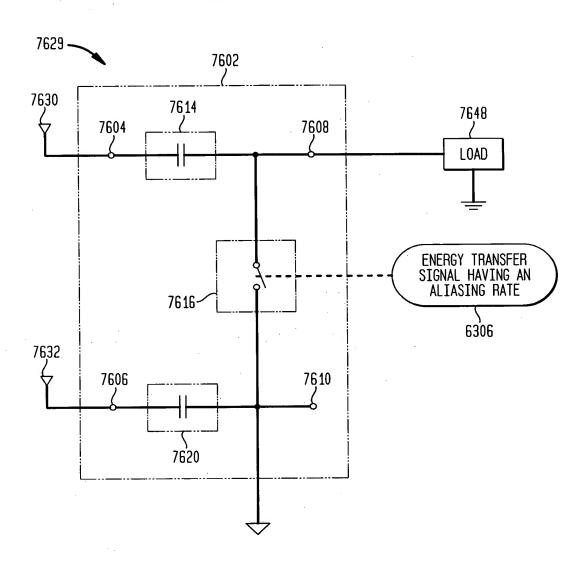


FIG. 76C SINGLE INPUT TO DIFFERENTIAL OUTPUT



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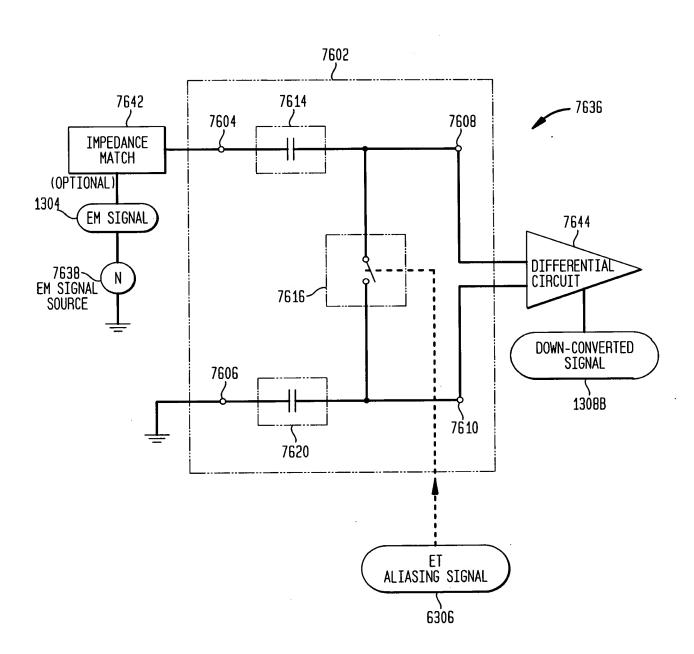
FIG. 76D DIFFERENTIAL INPUT TO SINGLE OUTPUT



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FIG. 76E EXAMPLE INPUT/OUTPUT CIRCUITRY



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FIG. 77A

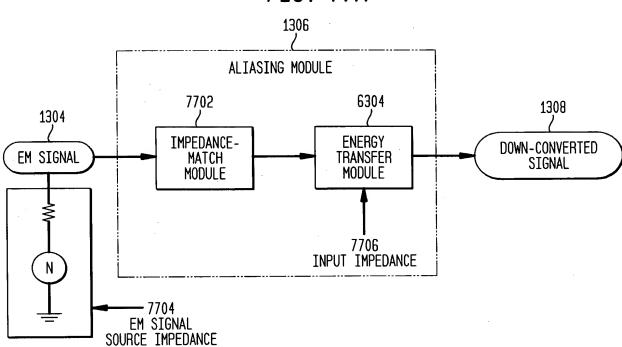
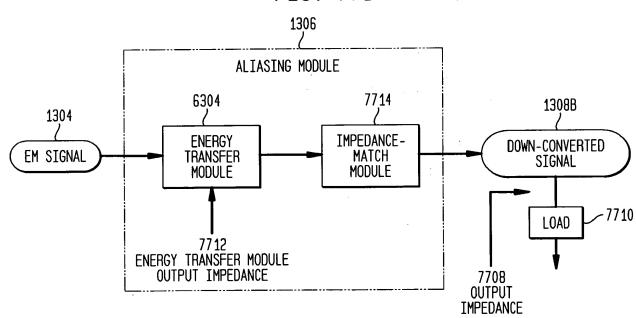
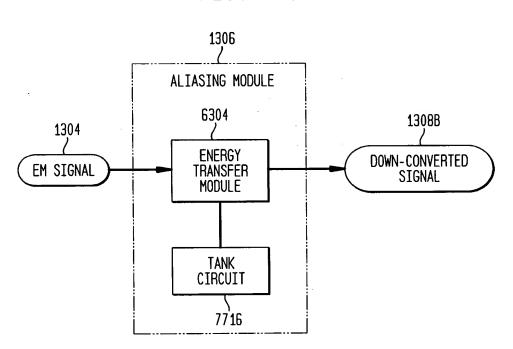


FIG. 77B



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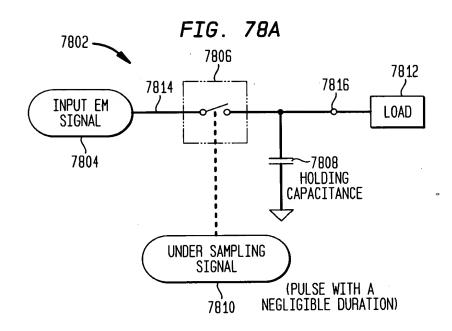
FIG. 77C

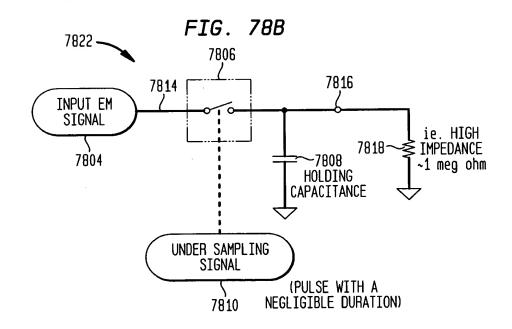


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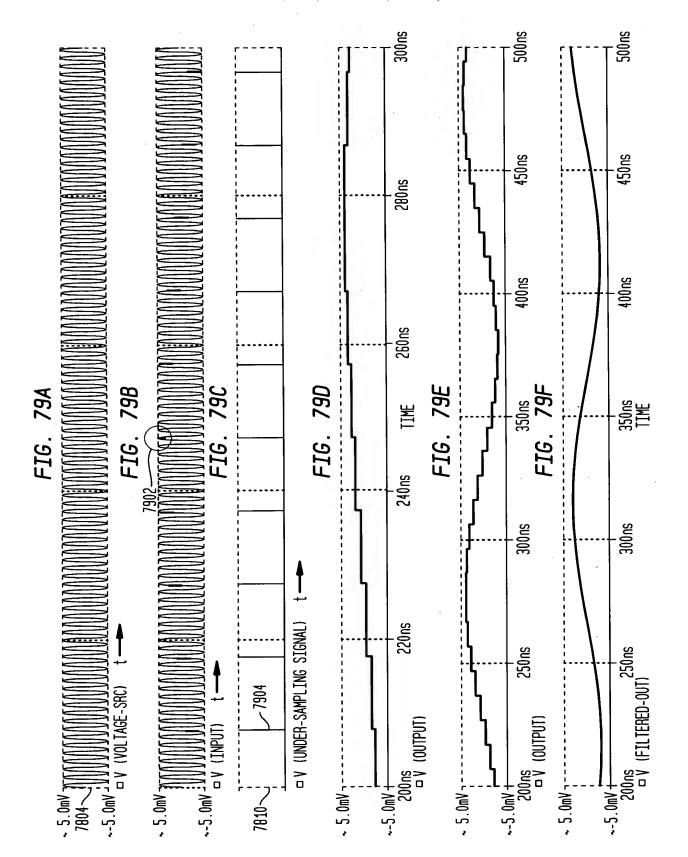
Appl. No. 09/550,644; Filed: Apr 14, 2000 Dkt No. 1744.0010009; Group Unit: 2688

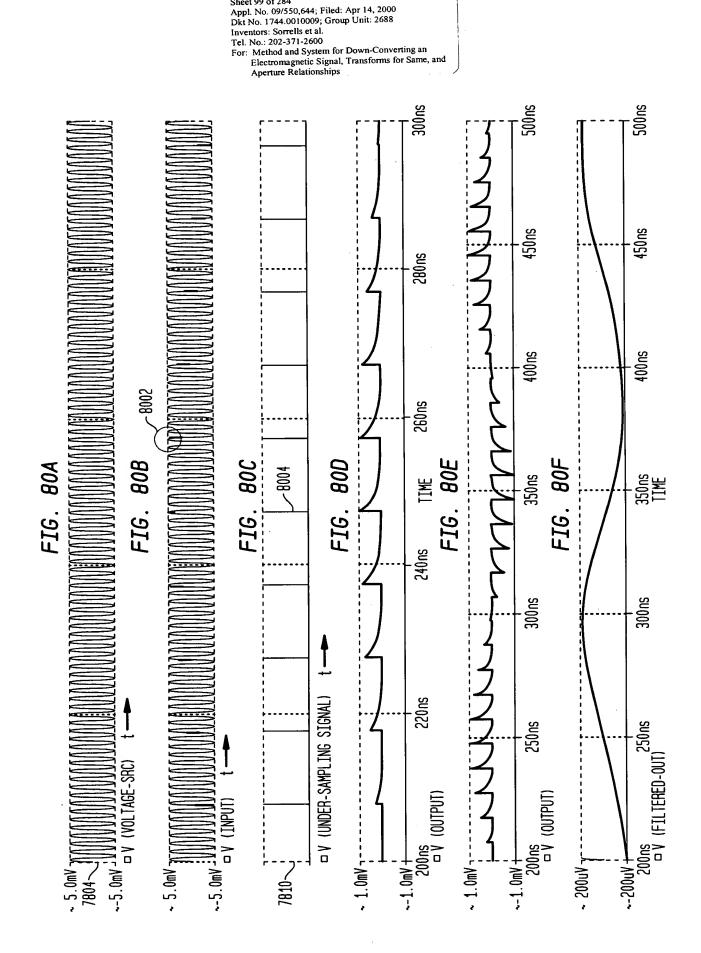
Inventors: Sorrells et al. Tel. No.: 202-371-2600



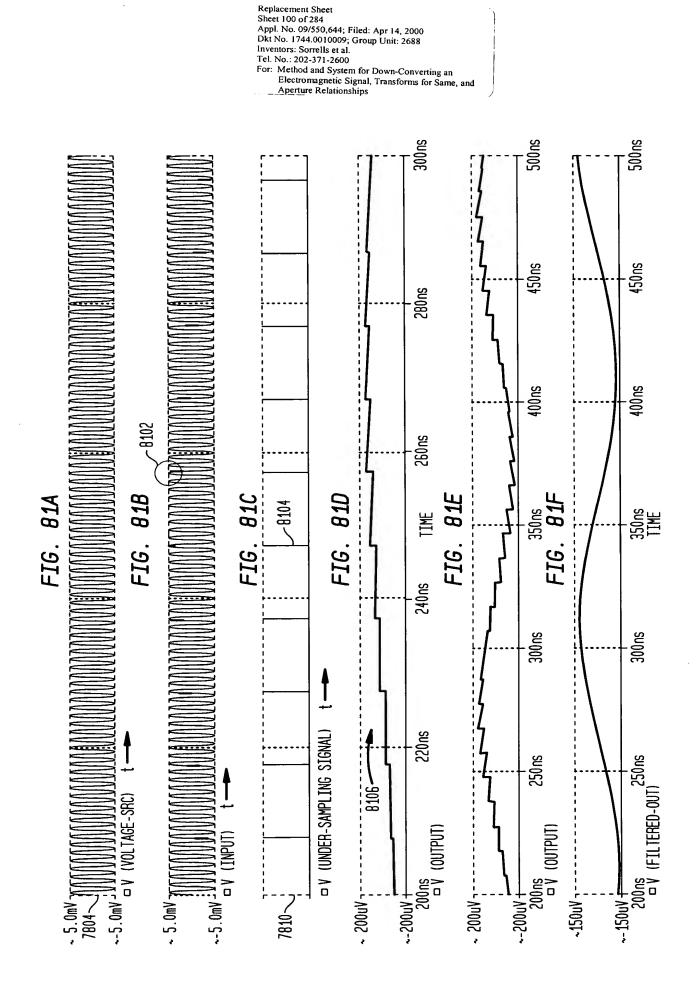


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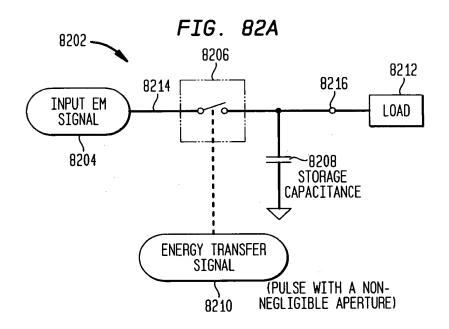


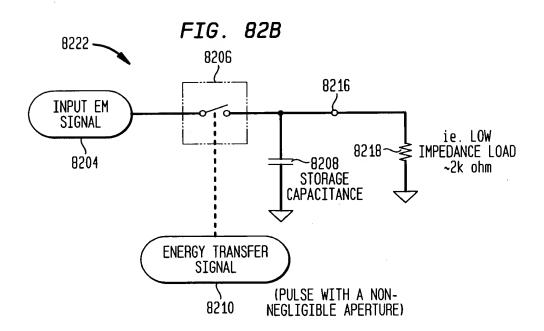


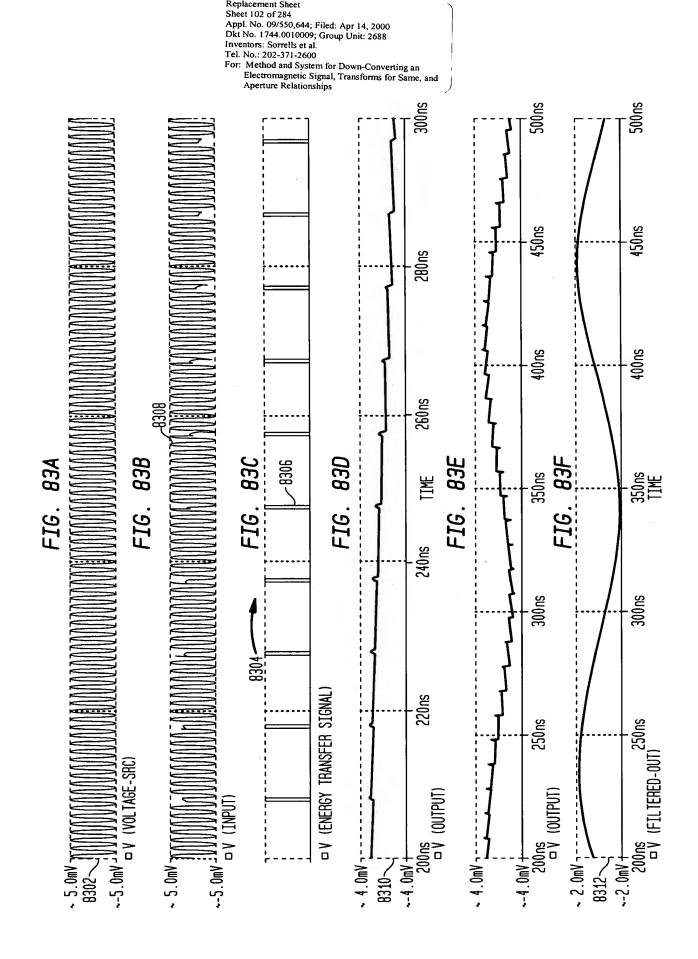
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Inventors: Soffens et al.

Tel. No.: 202-371-2600

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## FIG. 84A

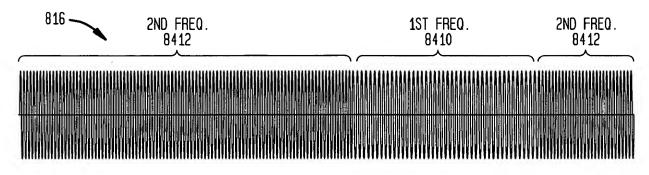
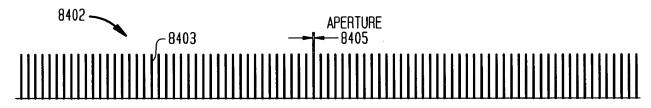
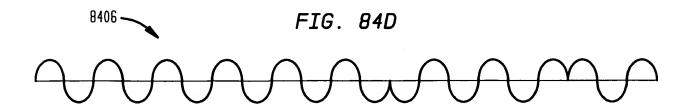


FIG. 84B





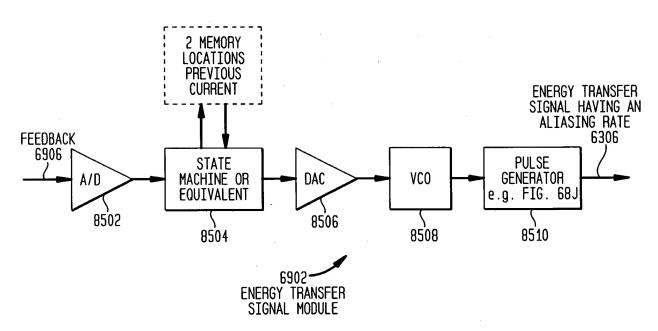


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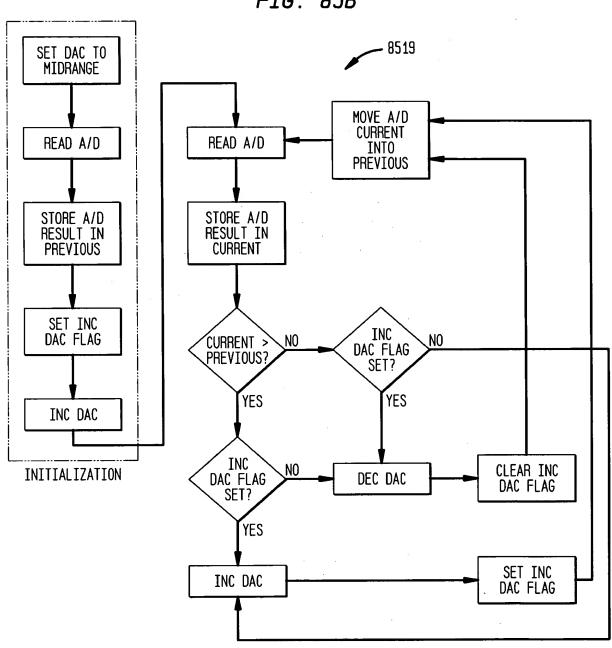
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FIG. 85A



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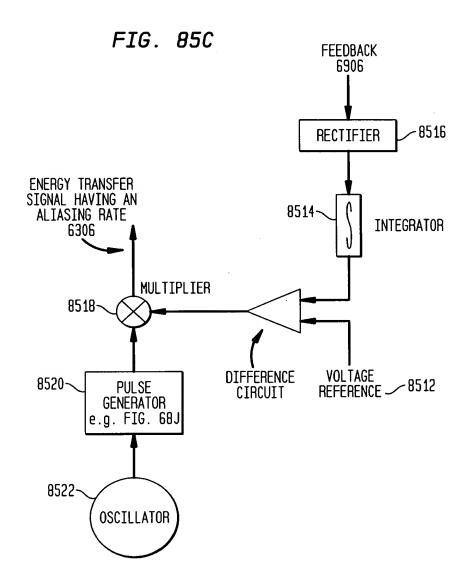
FIG. 85B



STATE MACHINE FLOWCHART

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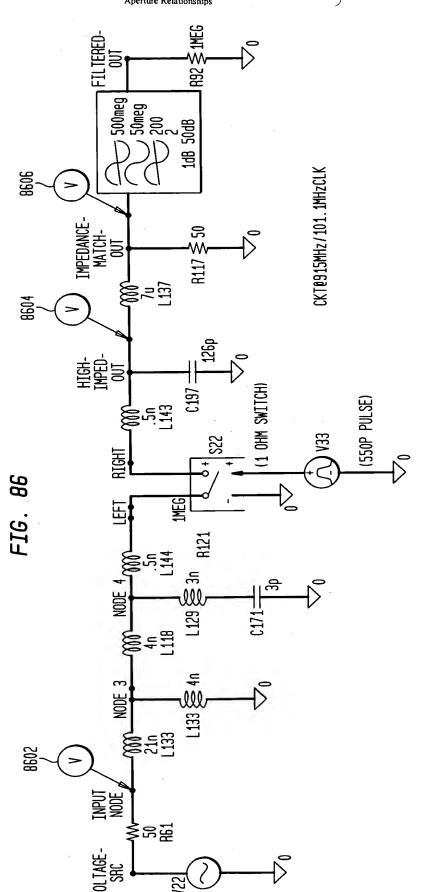


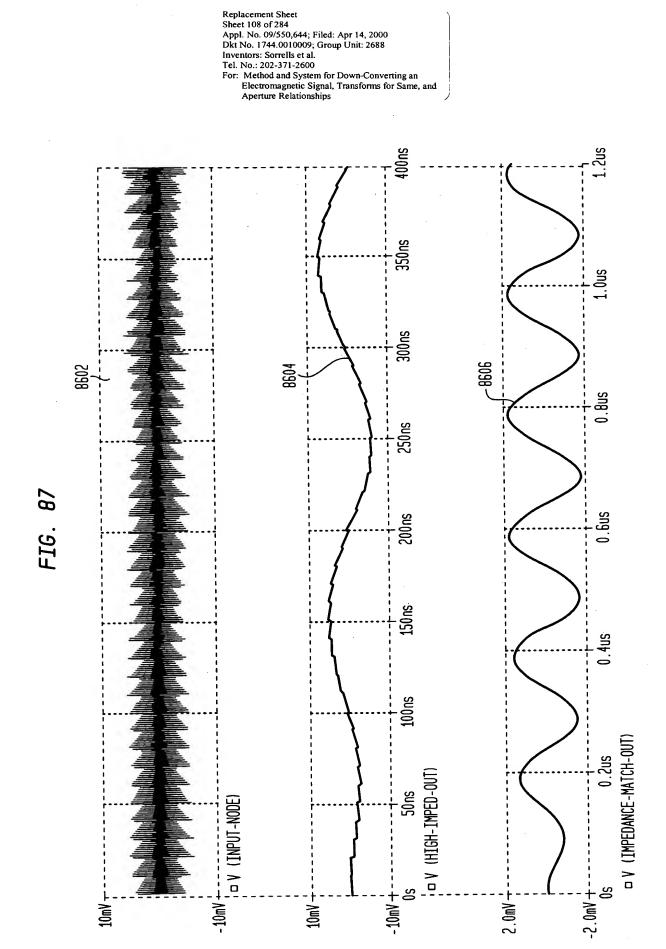
ENERGY TRANSFER SIGNAL MODULE 6902

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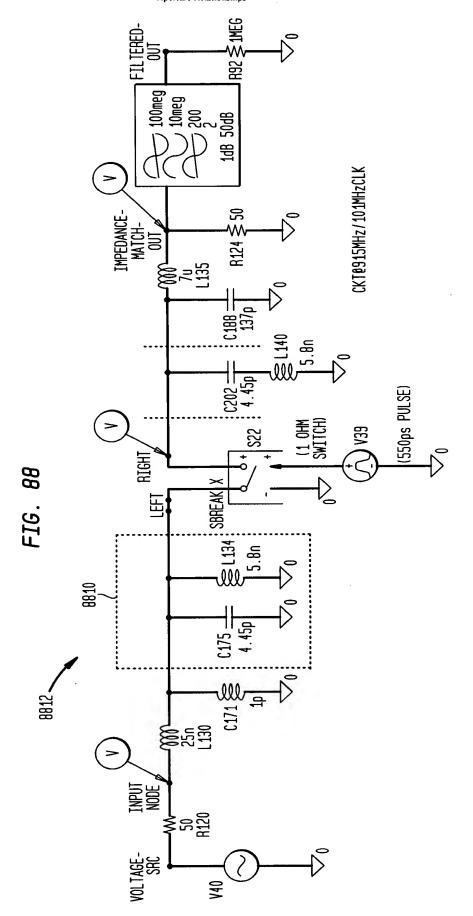
Inventors: Sorrells et al. Tel. No.: 202-371-2600





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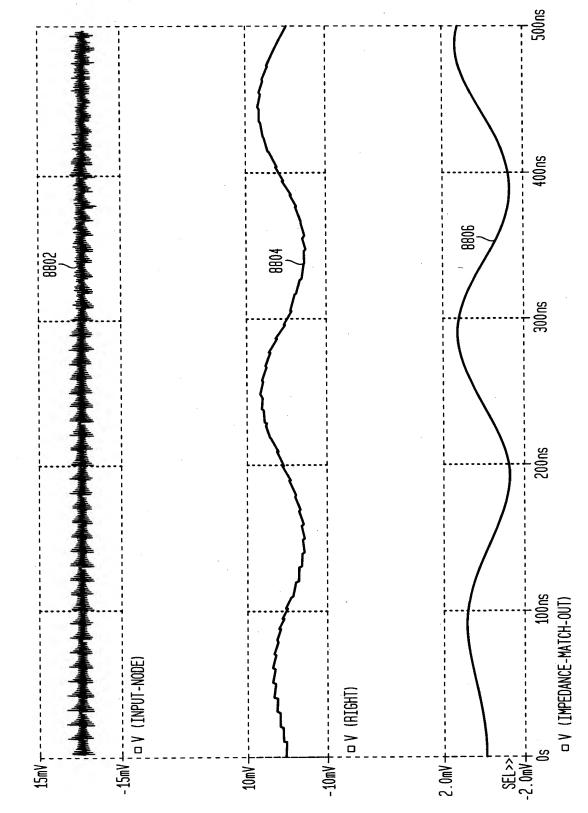
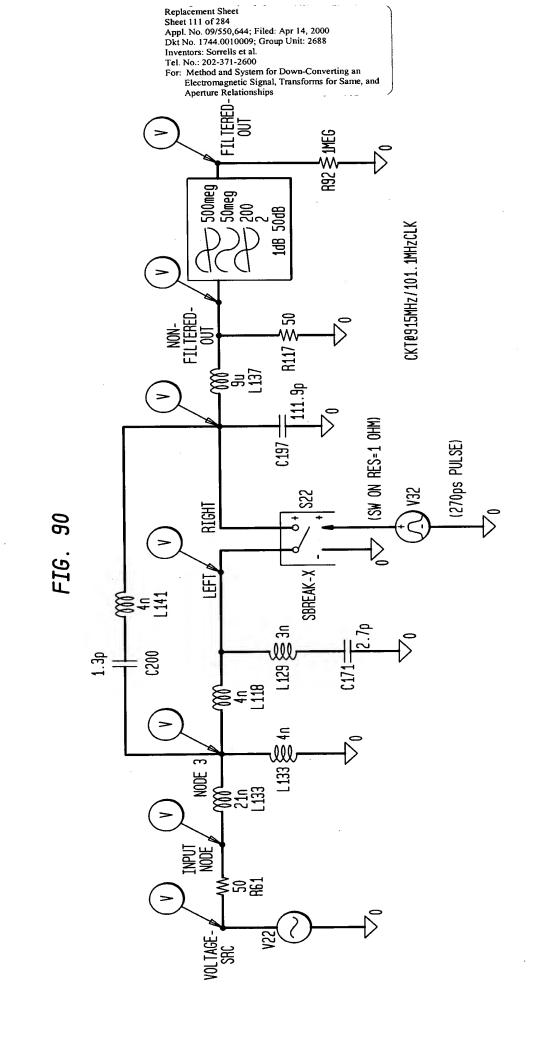


FIG. 89



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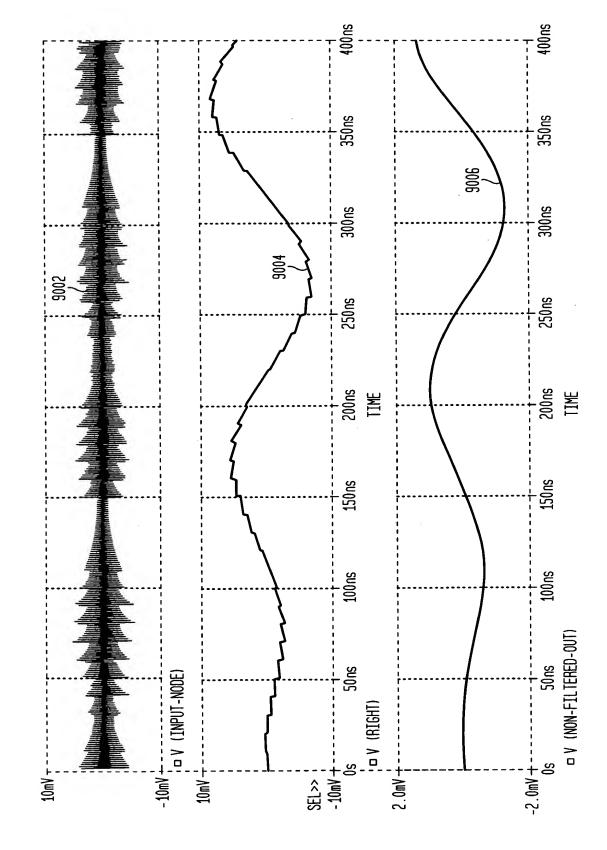
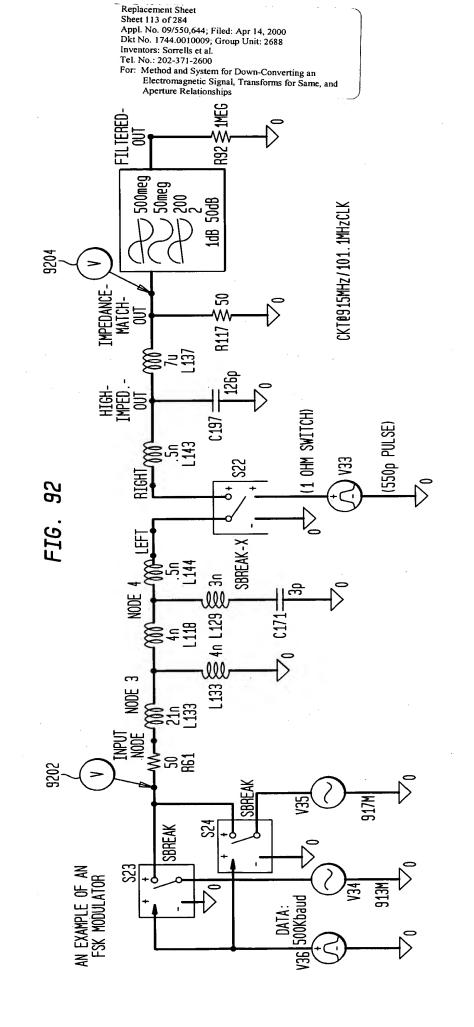
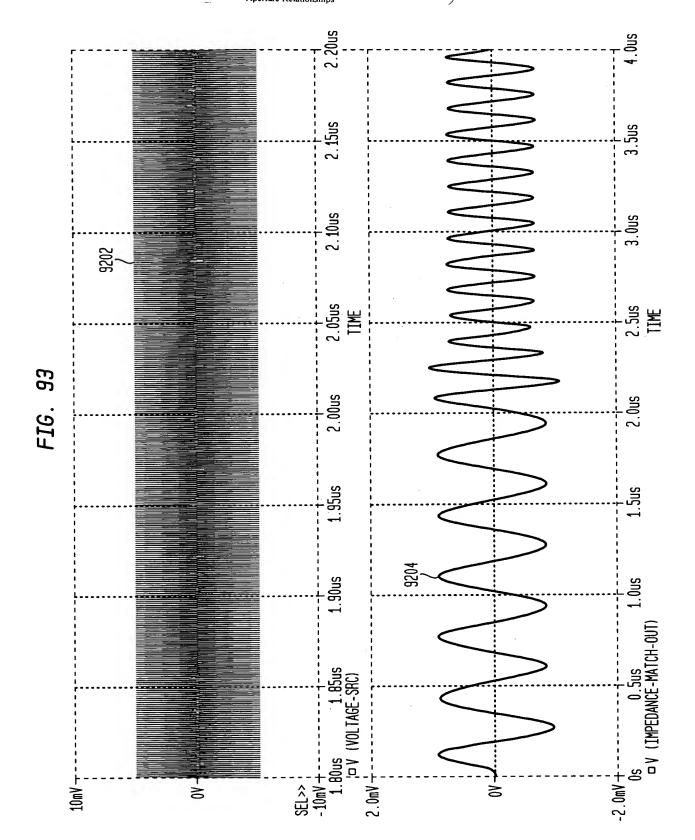


FIG. 91

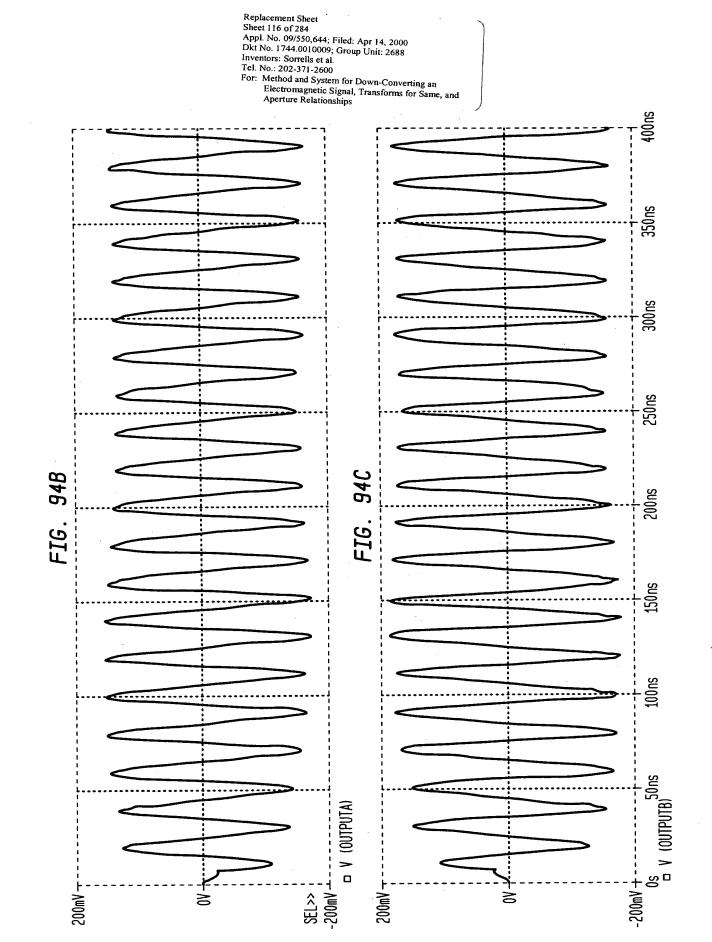


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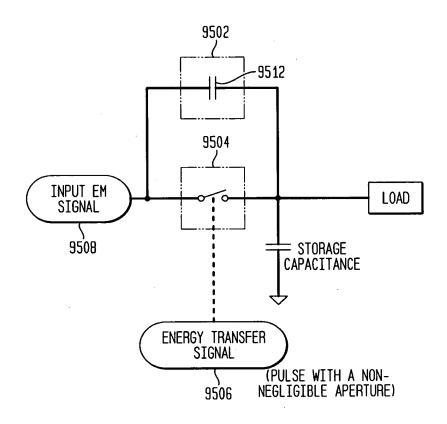
Appl. No. 09/550,644; Filed: Apr 14, 2000 Dkt No. 1744.0010009; Group Unit: 2688 Inventors: Sorrells et al. Tel. No.: 202-371-2600 For: Method and System for Down-Converting an Electromagnetic Signal, Transforms for Same, and Aperture Relationships OUTPUT FREO. 50Mhz PHASE A 9444 -550ps OUTPUT 1 **OUTPUT** FIG. 94A ₩ 韶 SBREAK-X  $\sim$ ENERGY TRANSFER SIGNAL 9442~ ュギ゙゙゙゙゙゙゙゙゙゙゙゙゙゙゙゙゙゙゙゚゚

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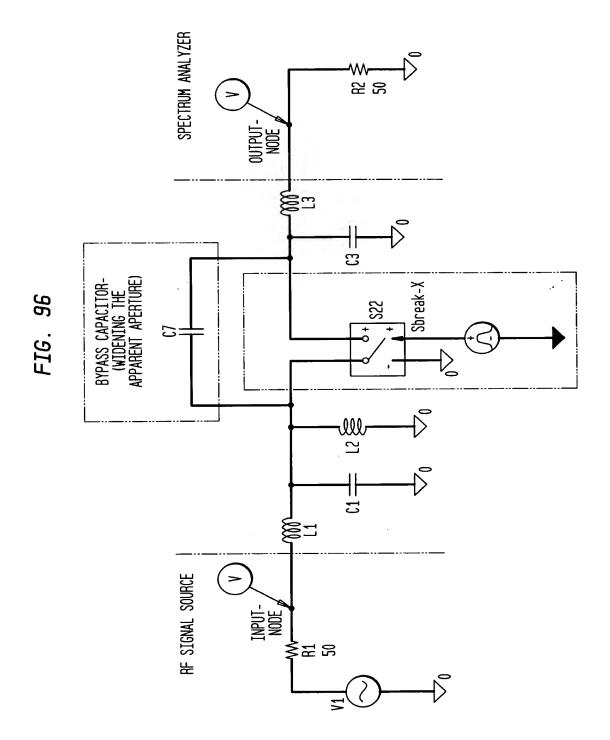


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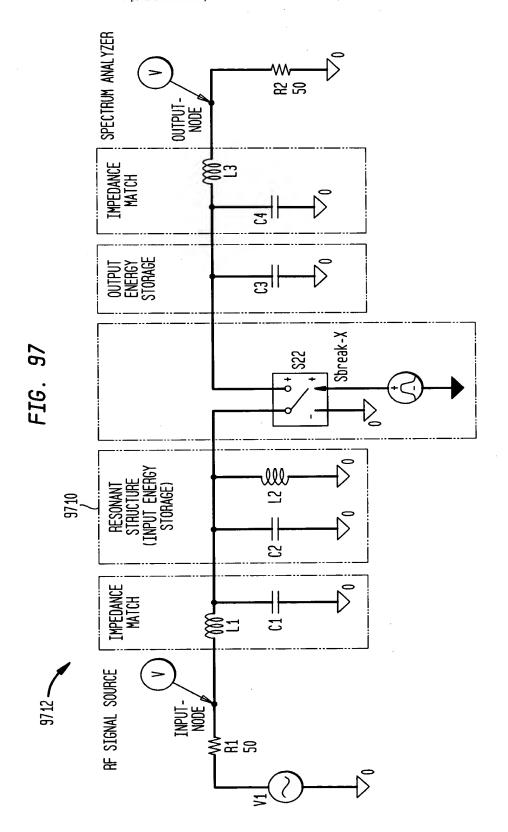
FIG. 95



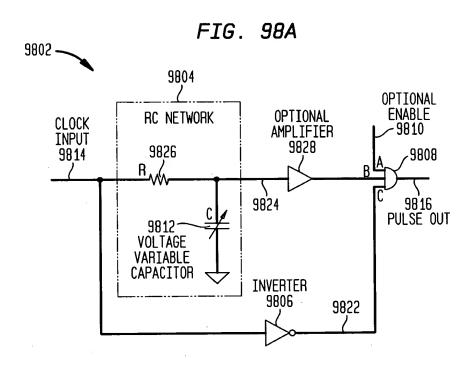
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Appl. No. 09/550,644; Filed: Apr 14, 2000
Dkt No. 1744.0010009; Group Unit: 2688
Inventors: Sorrells et al.
Tel. No.: 202-371-2600
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Inventors: Sorrells et al.
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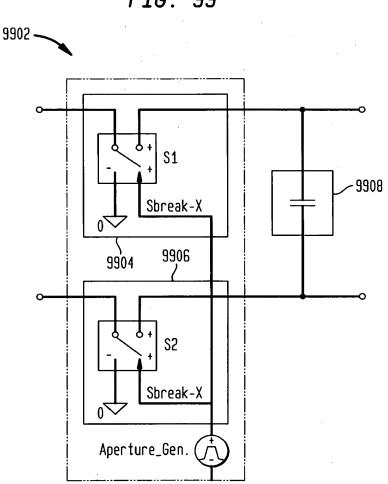


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Appl. No. 09/550,644; Filed: Apr 14, 2000
Dkt No. 1744.0010009; Group Unit: 2688
Inventors: Sorrells et al.
Tel. No.: 202-371-2600
For: Method and System for Down-Converting an
Electromagnetic Signal, Transforms for Same, and
Aperture Relationships APERTURE 9820 ENERGY TRANSFER SIGNAL 9816 OPTIONAL ENABLE 9810 DELAYED CLOCK 9824 -INVERTED CLOCK 9822 -LESS C CL 0CK 9814 FIG. 98E FIG. 98F FIG. 98D FIG. 98B FIG. 98C

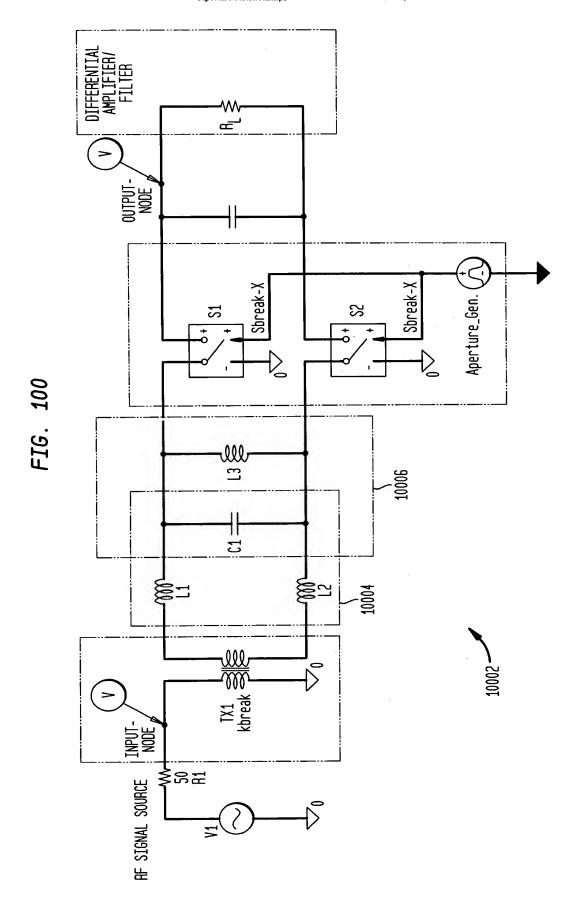
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Inventors: Sorrells et al.
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For: Method and System for Down-Converting an
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Aperture Relationships

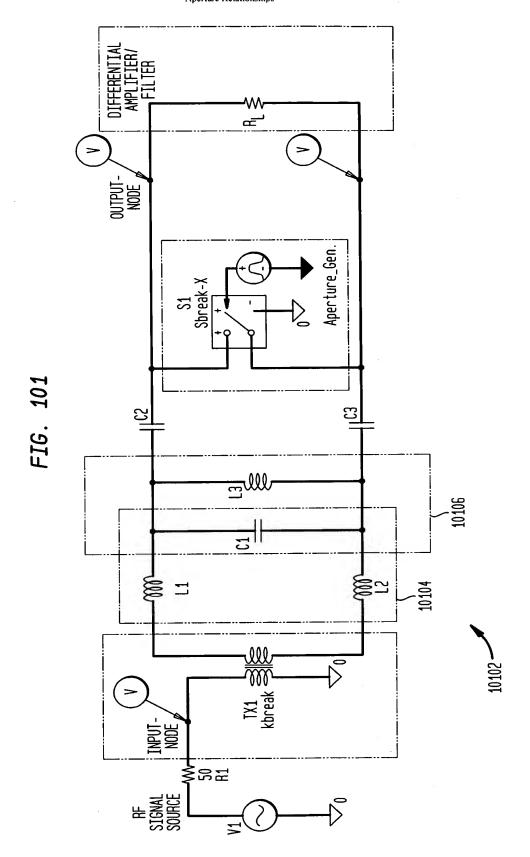
FIG. 99



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Inventors: Sorrells et al.
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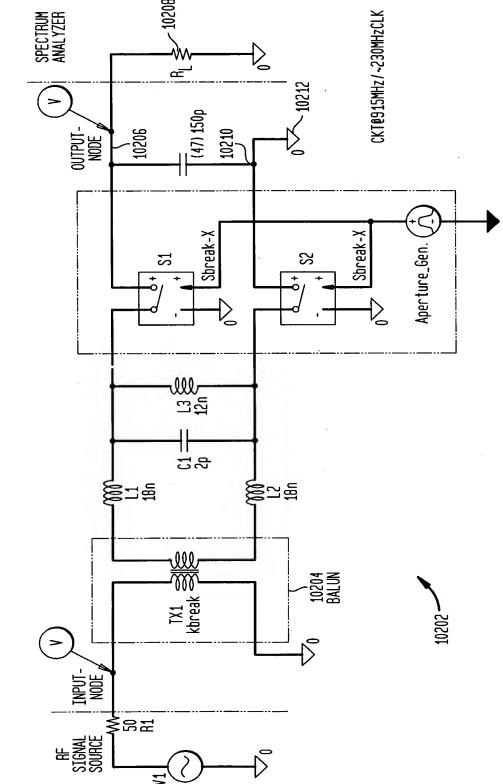


FIG. 102

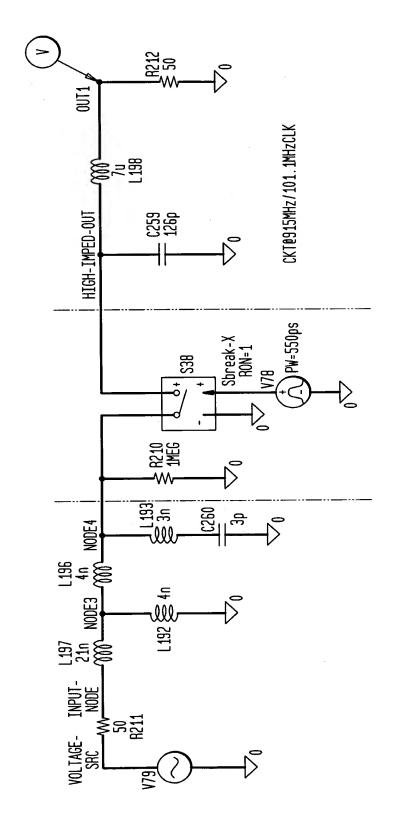
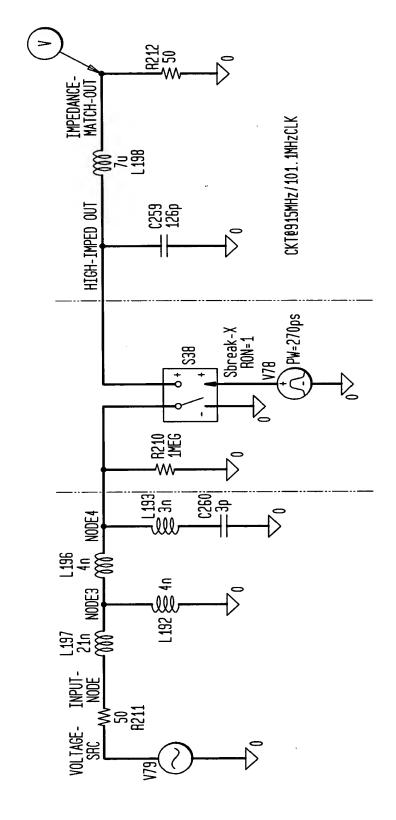
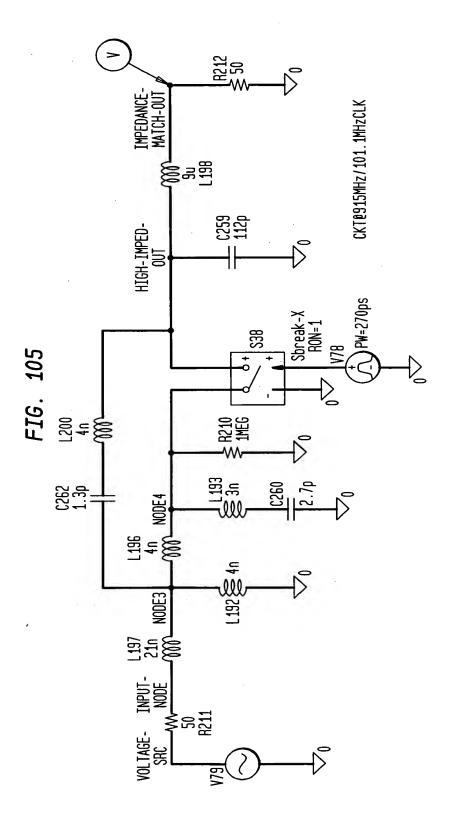


FIG. 103

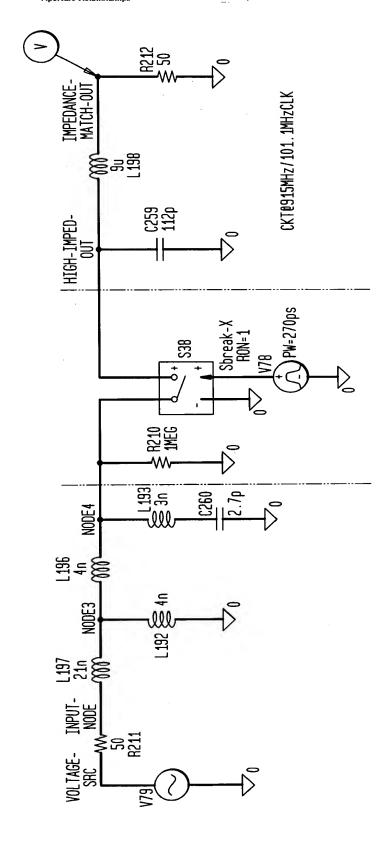
Tel. No.: 202-371-2600



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Dkt No. 1744.0010009; Group Unit: 2688
Inventors: Sorrells et al.
Tel. No.: 202-371-2600



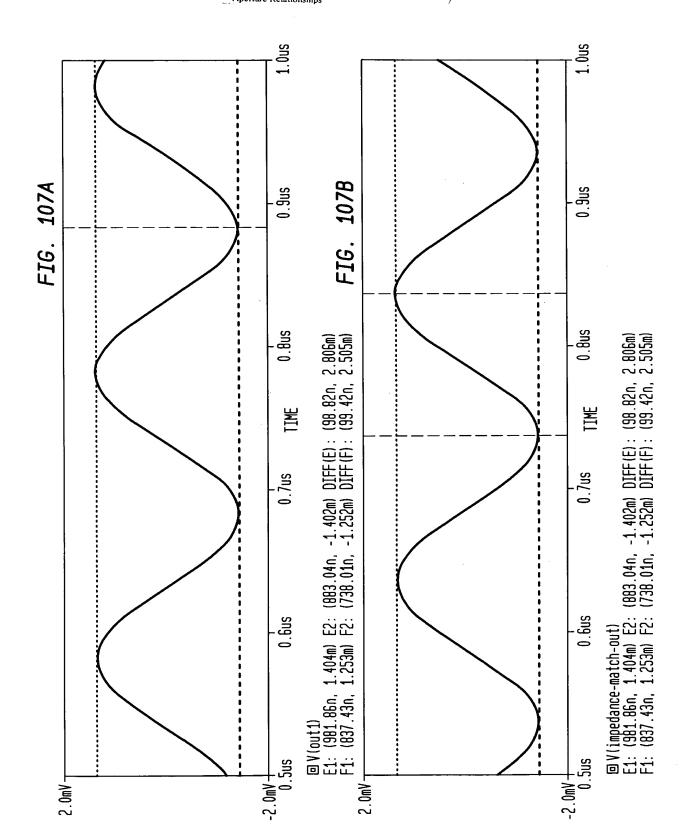
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Appl. No. 09/550,644; Filed: Apr 14, 2000
Dkt No. 1744.0010009; Group Unit: 2688
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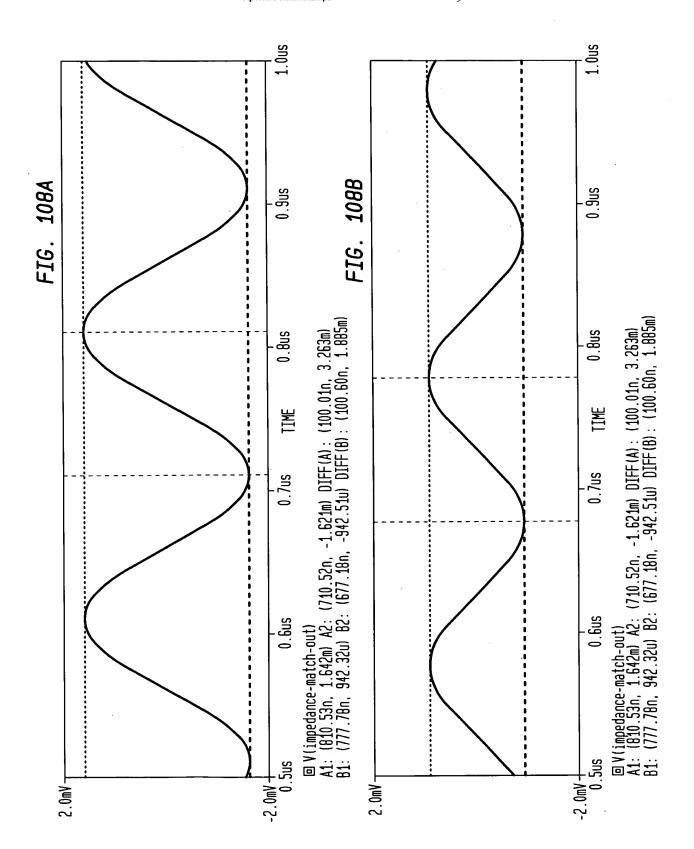
Appl. No. 09/550,644; Filed: Apr 14, 2000 Dkt No. 1744.0010009; Group Unit: 2688

Inventors: Sorrells et al. Tel. No.: 202-371-2600



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SWITCH S

CAPACITOR
10906

PULSES
10910
10908

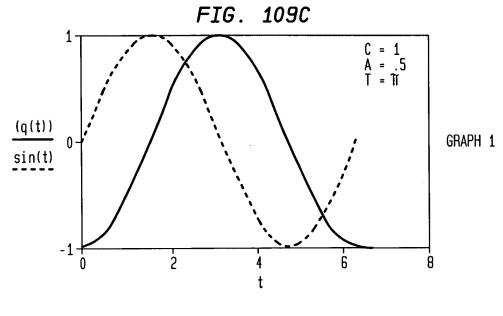
FIG. 109B

q=C•V	EQ. 10
V=A·sin(t)	EQ. 11
$q(t) = C \cdot A \cdot \sin(t)$	EQ. 12
$\Delta q(t) = C \cdot A \cdot \sin(t) - C \cdot A \cdot \sin(t-T)$	EQ. 13
$\triangle q(t) = C \cdot A \cdot (sin(t) - sin(t-T))$	EQ. 14
$\sin(\infty) - \sin(\beta) = 2 \cdot \sin(\frac{\infty - \beta}{2}) \cdot \cos(\frac{\infty + \beta}{2})$	EQ. 15
$\triangle q(t) = 2 \cdot C \cdot A \cdot \sin\left[\frac{t - (t - T)}{2}\right] \cdot \cos\left[\frac{t + (t - T)}{2}\right]$	EQ. 16
$\triangle q(t) = 2 \cdot C \cdot A \cdot \sin(\frac{1}{2} \cdot T) \cdot \cos(t - \frac{1}{2} \cdot T)$	EQ. 17
$q(t) = \int_{0}^{\infty} C \cdot A \cdot (\sin(t) - \sin(t - T)) dt$	EQ. 18
$q(t) = -\cos(t) \cdot C \cdot A + \cos(t-T) \cdot C \cdot A$	EQ. 19
$q(t) = C \cdot A \cdot (cos(t-T) - cos(t))$	EQ. 20

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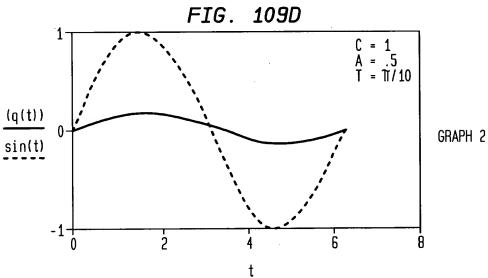


FIG. 109E

POWER-CHARGE RELATIONSHIP q=C•V V=q/C V=J/C EQ. 21 EQ. 22 EQ. 23 J=q<sup>2</sup>/C EQ. 24 P=J/S EQ. 25

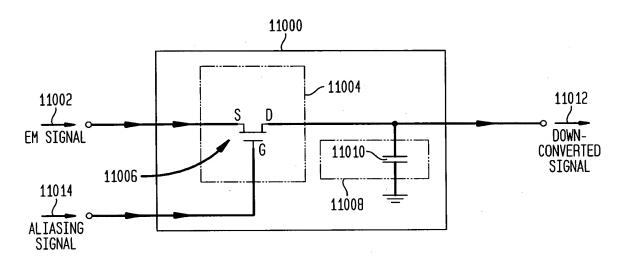
$$P=q^2$$

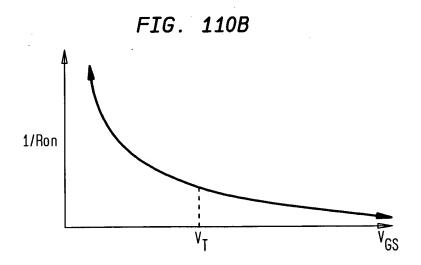
EQ. 26

## FIG. 109F

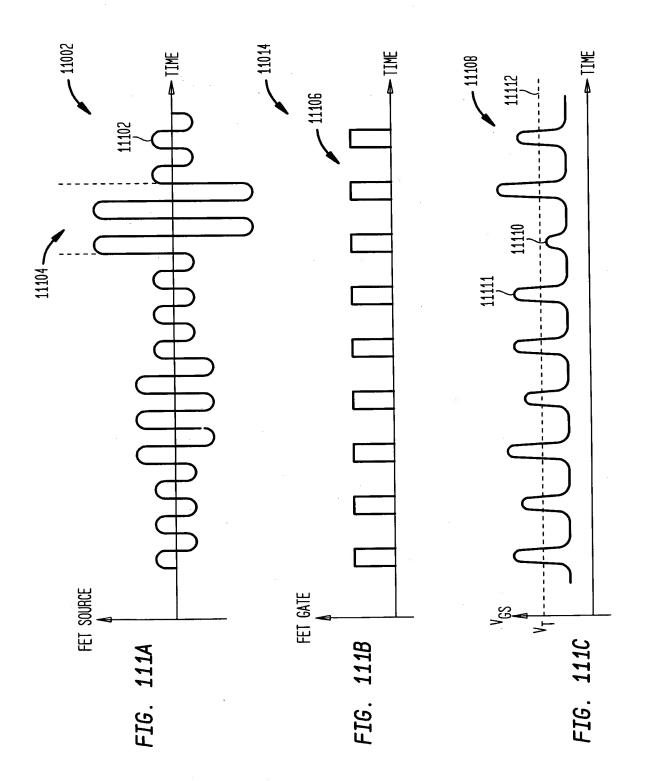
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Inventors: Sorrells et al.
Tel. No.: 202-371-2600

FIG. 110A

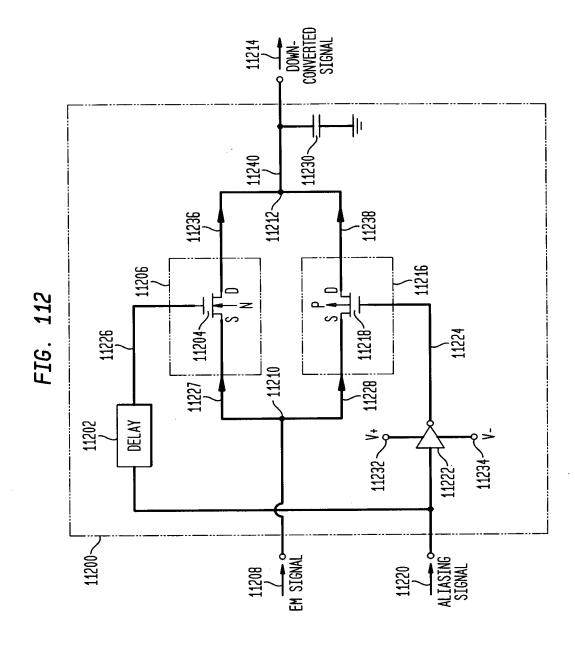




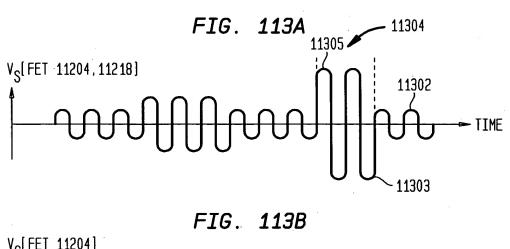
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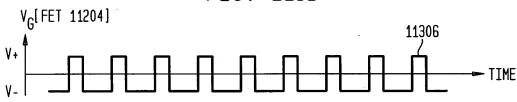


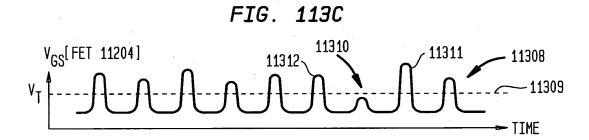
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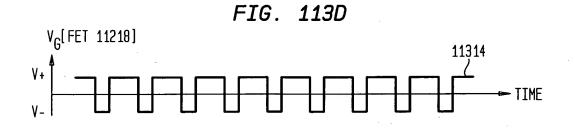
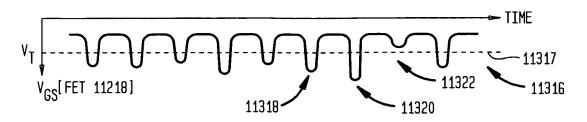
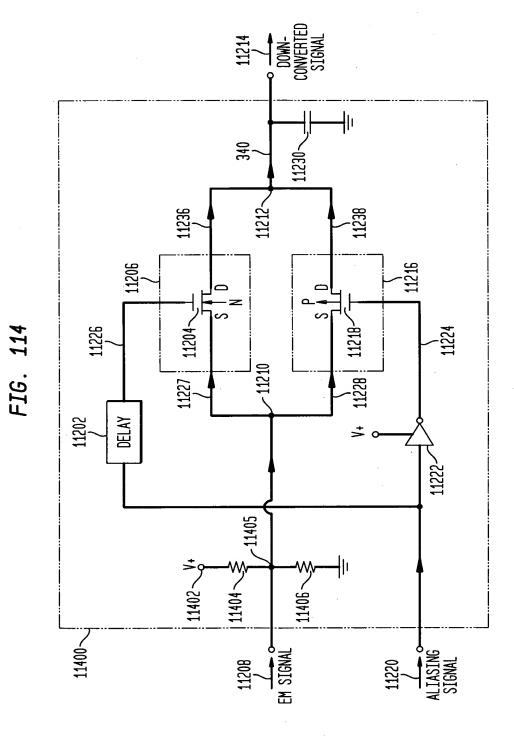


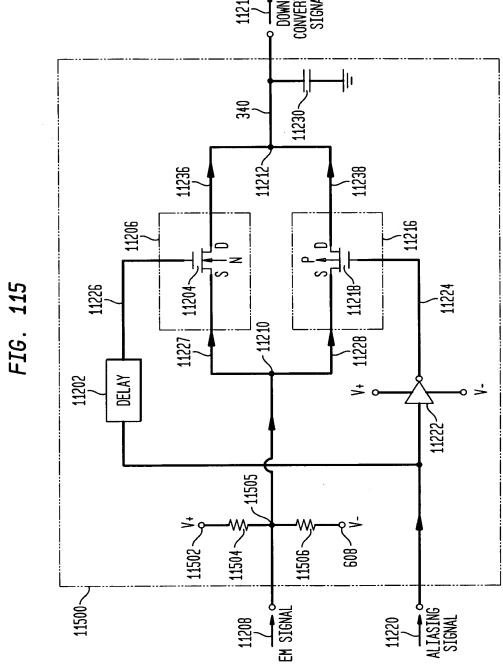
FIG. 113E



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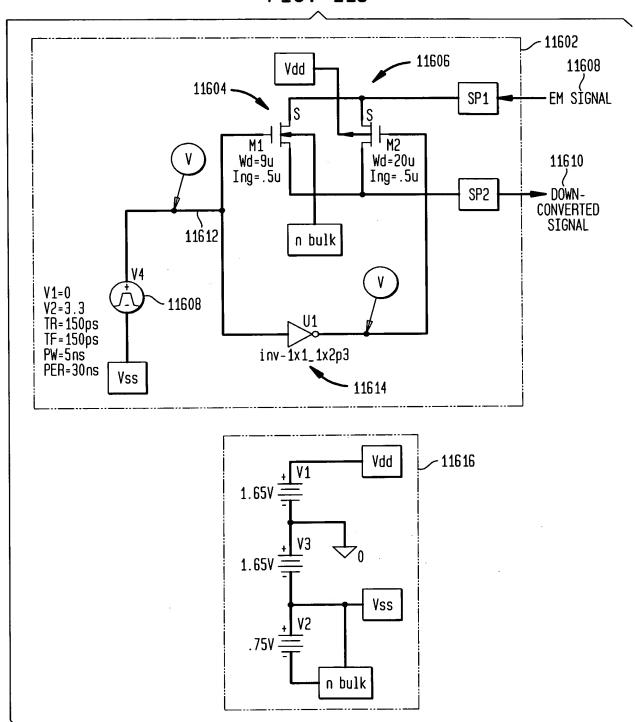


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Inventors: Sorrells et al.
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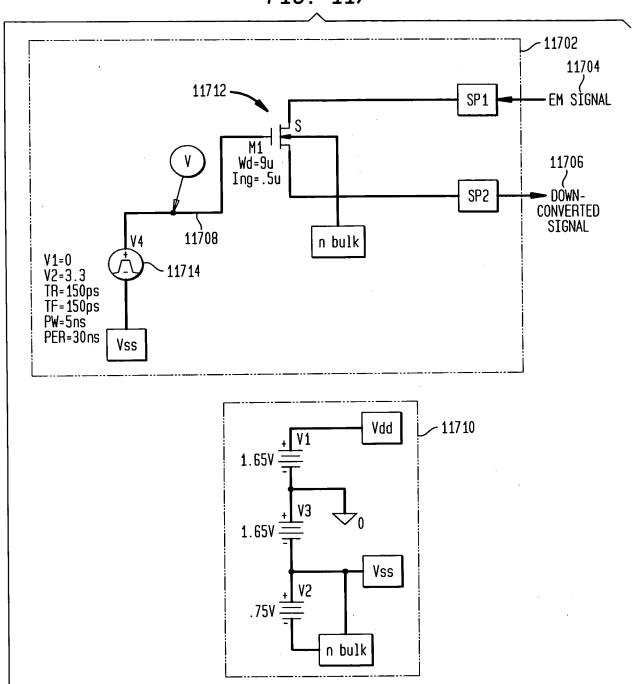
Replacement Sheet Replacement Sheet
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Dkt No. 1744.0010009; Group Unit: 2688
Inventors: Sorrells et al.
Tel. No.: 202-371-2600

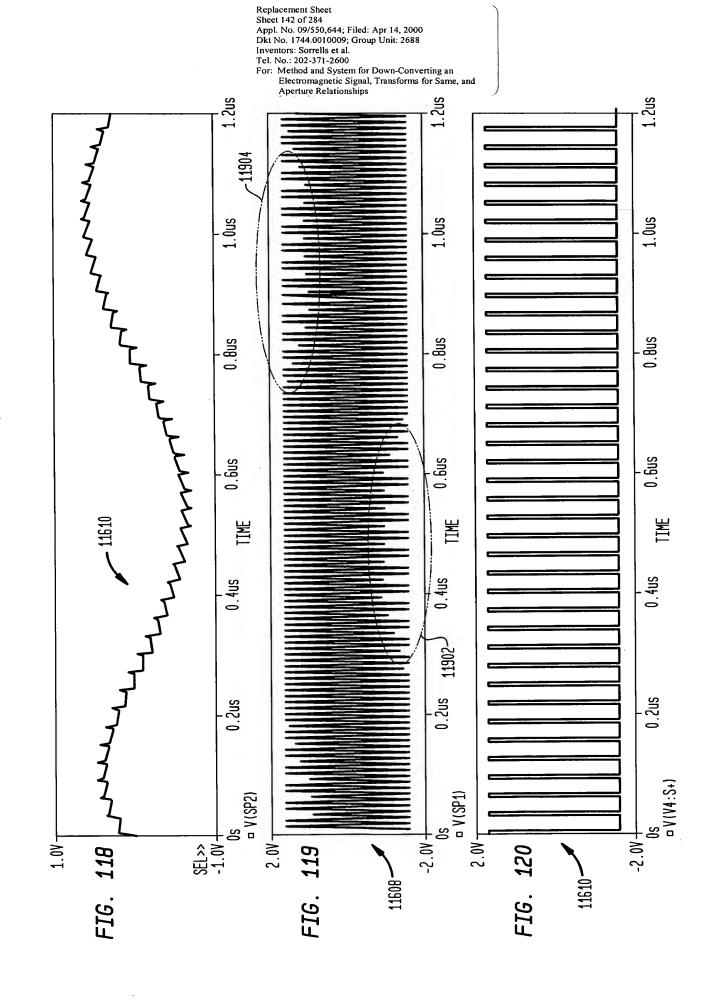
FIG. 116

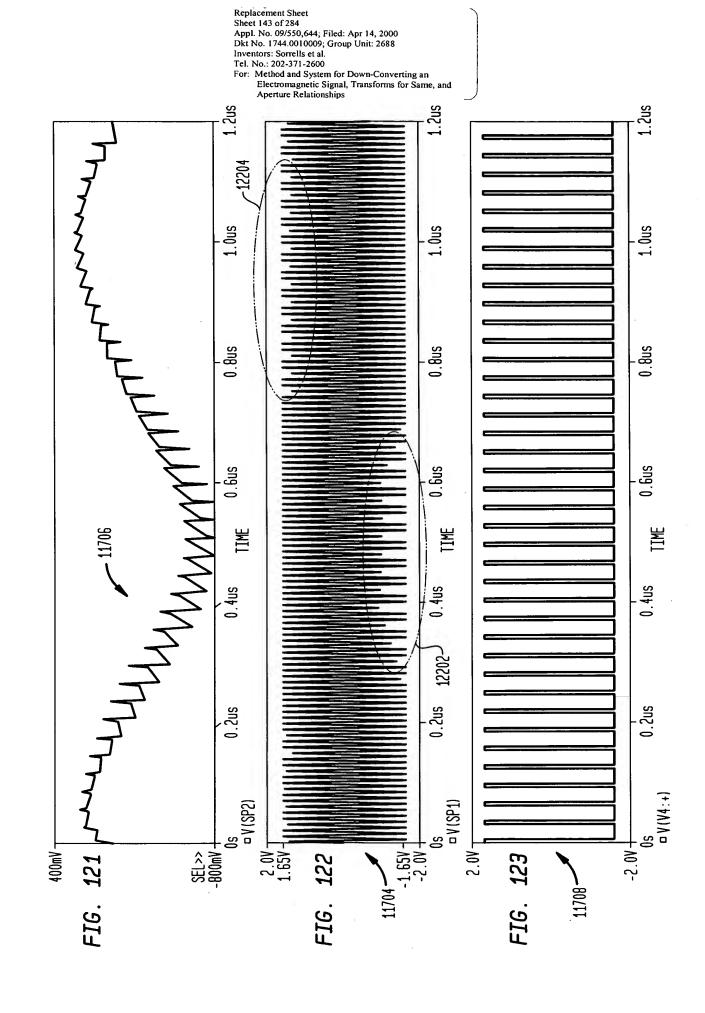


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Inventors: Sorrells et al.
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Aperture Relationships

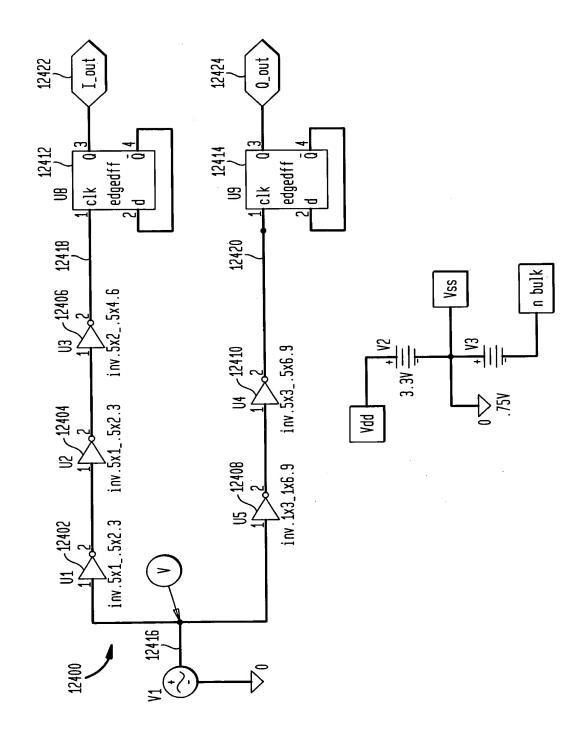
FIG. 117







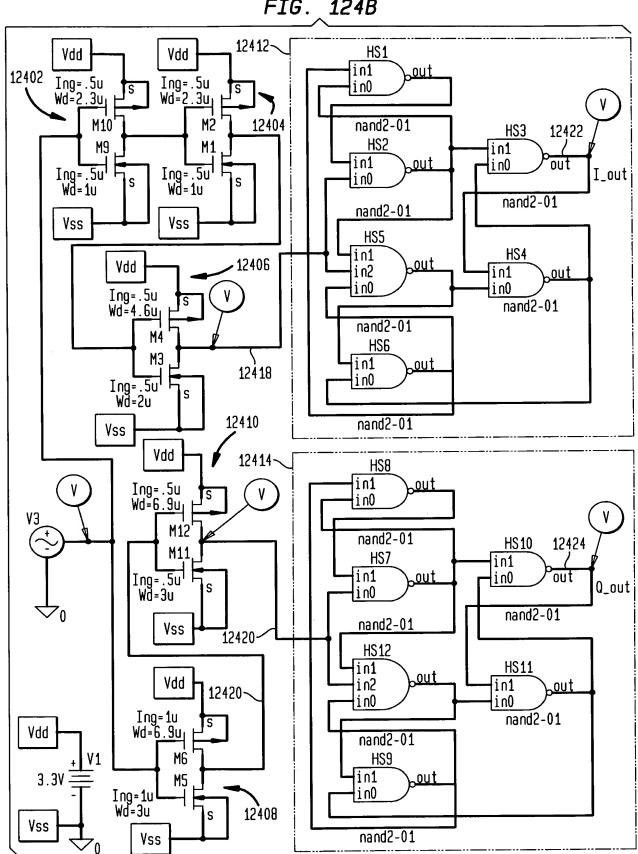
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Inventors: Sorrells et al.
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Aperture Relationships

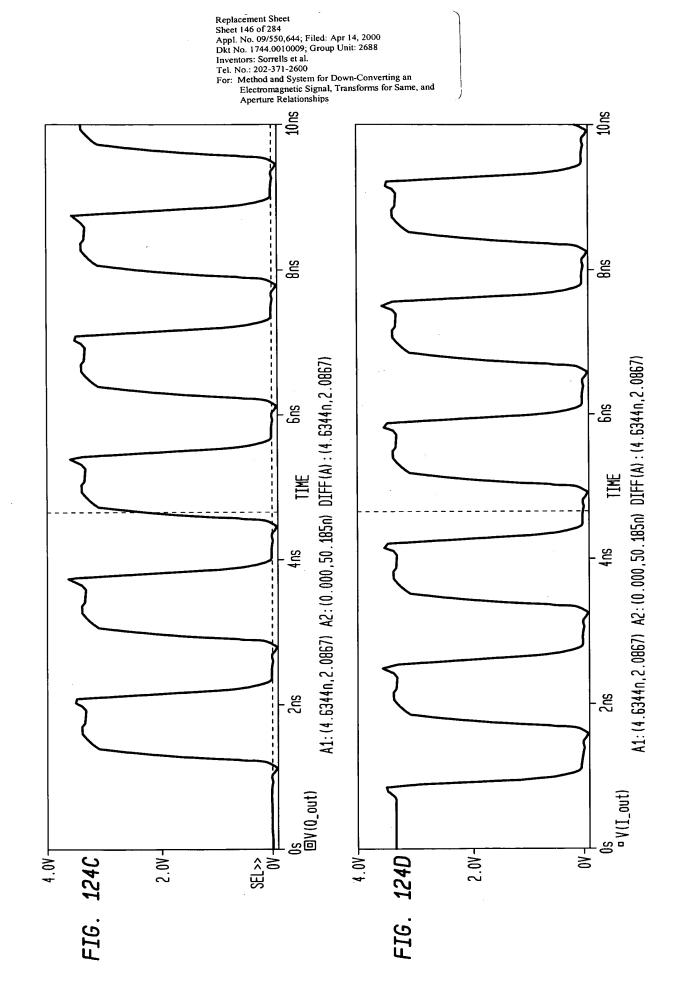


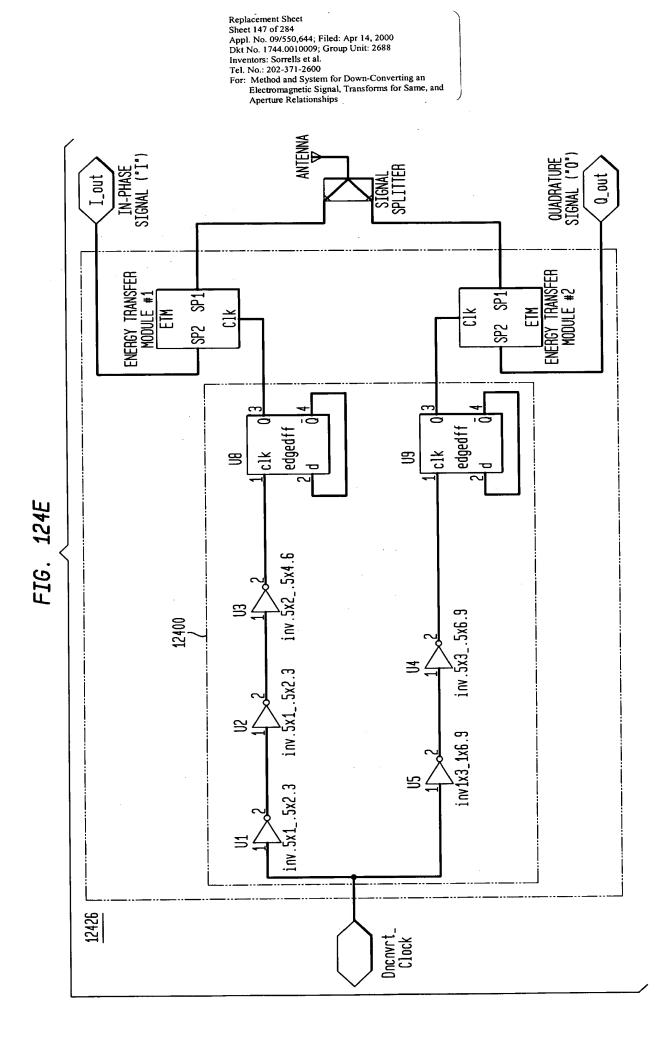
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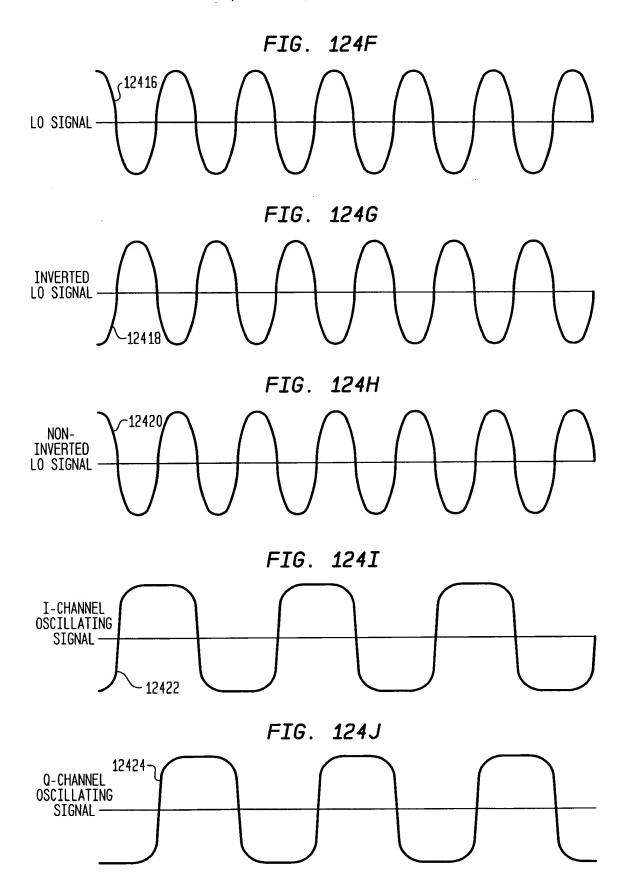




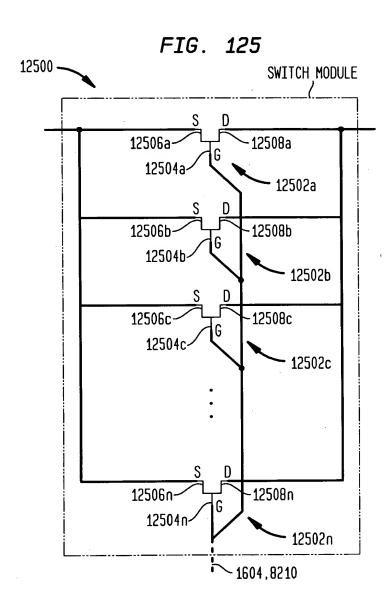
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Inventors: Sorrells et al. Tel. No.: 202-371-2600

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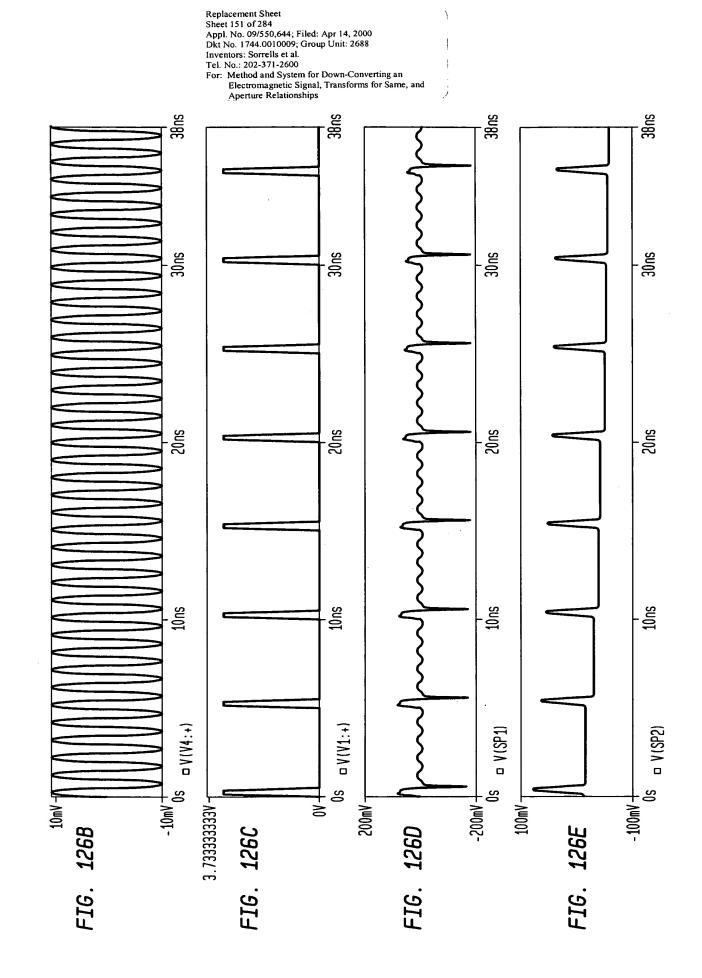


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Aperture Relationships

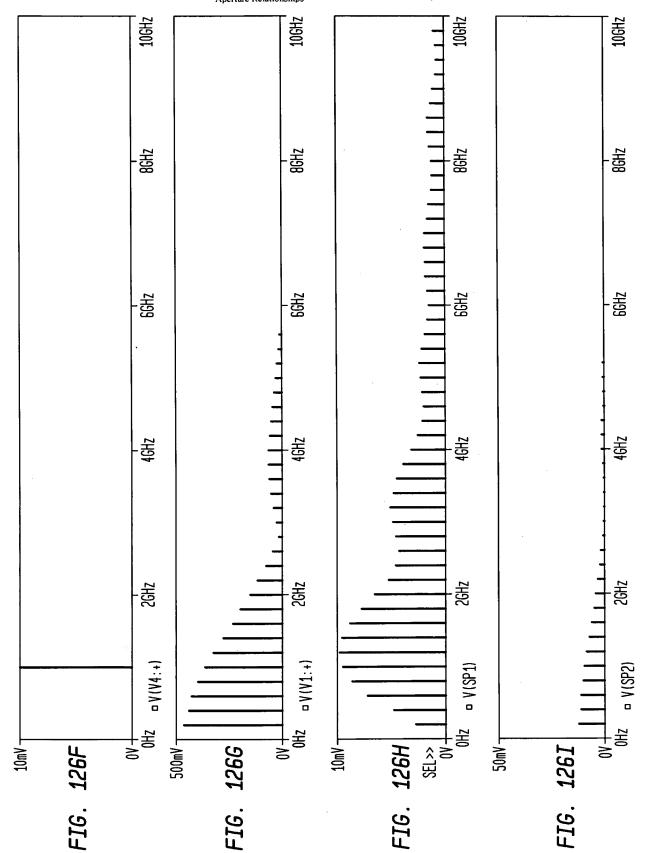


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 :
 ≅≶ 12632 12612 /M15 叟 Wd=20u Ing=.5u Wd=20u Ing=.5u FIG. 126A S Vampl=10mV Freq=1010Meg Wd=20u Ing=.5u Wd=20u Ing=.5u S 12610 12630 M14 도  $S_{2}$ 12608 12628 (M33 ¥ Wd=20u Ing=.5u Wd=20u Ing=.5u S S λđ Wd=20u Ing=.5u Wd=20u Ing=.5u 12626 12606 £ 12604 12624 Wd=20u Ing=.5u Wd=20u Ing=.5u S 757 3.3 Wd=20u Ing=.5u Wd=20u Ing=.5u Vsub 12602 12622 M197 Vsub 12648 V1=0 V2=3.3 TR=150ps TF=150ps PW=200ps PER=5ns =\$음

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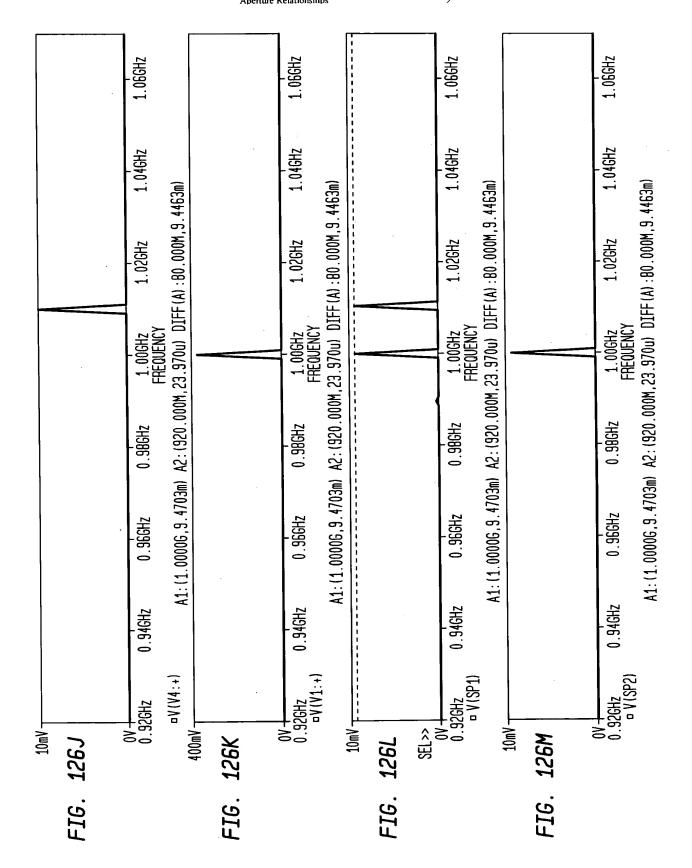
Appl. No. 09/550,644; Filed: Apr 14, 2000

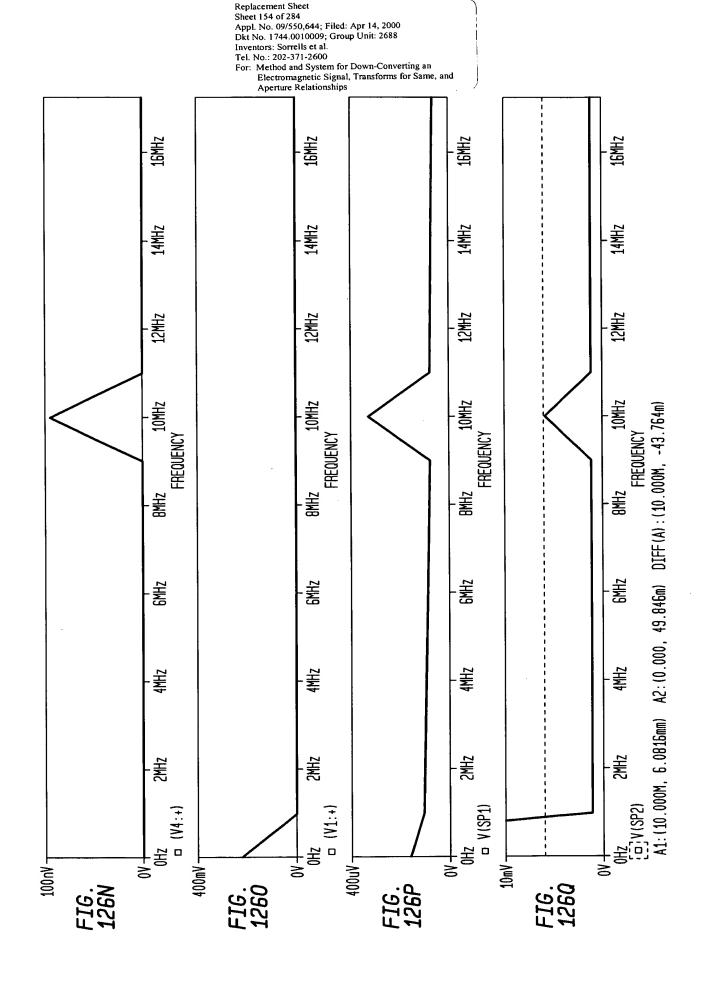
Dkt No. 1744.0010009; Group Unit: 2688

Inventors: Sorrells et al.

Tel. No.: 202-371-2600

For: Method and System for Down-Converting an Electromagnetic Signal, Transforms for Same, and Aperture Relationships

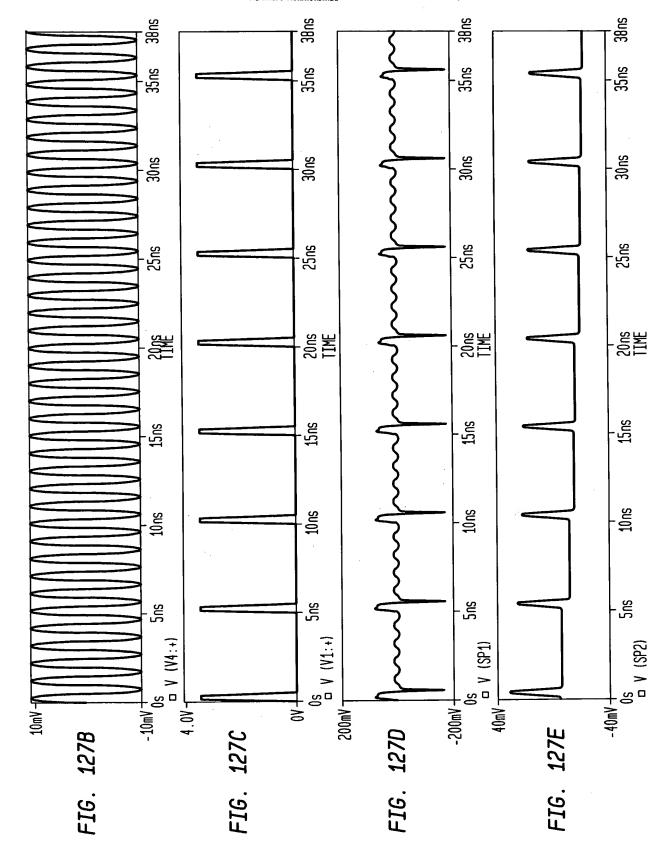




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Tel. No.: 202-371-2600
For: Method and System for Down-Converting an
Electromagnetic Signal, Transforms for Same, and
Aperture Relationships Vampl=10mV Freq=1010Meg 28 ₹ 띪 20 **SP2** SP2  $\frac{8}{2}$ Wd=20u Ing=.5u Wd=20u Ing=.5u S 乮 Wd=14u Ing=.5u Wd=14u Ing=.5u Md=10u Ing=.5u Wd=10u Ing=.5u  $\cong$ Md=8u Ing=.5u Wd=Bu Ing=.5u Wd=4u Ing=.5u Vsub

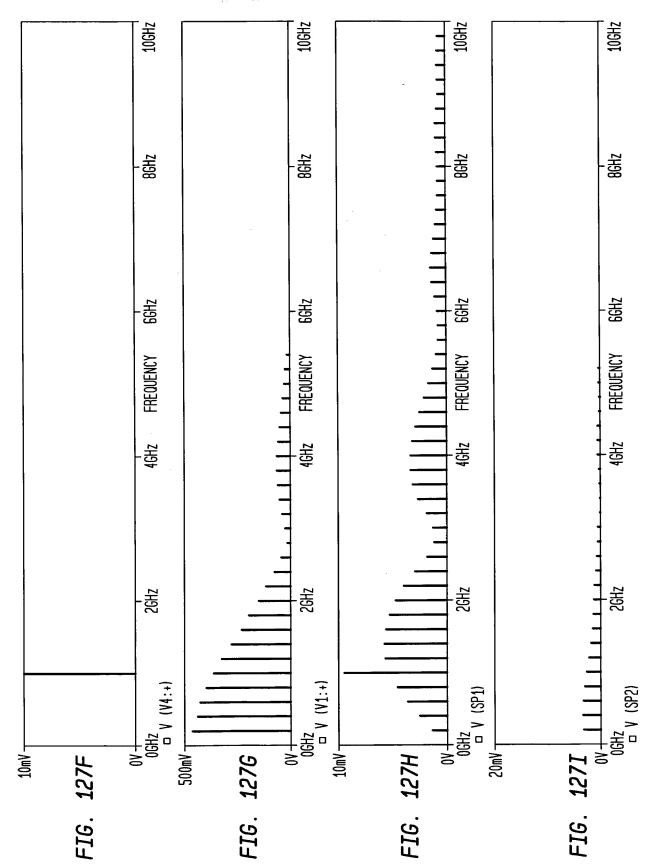
 $^{\text{SP}}$ 12714 /M15 12710 M14 12708 12706 M12\ £ Wd=2u Ing=.5u 3.3 75V Md=1u Ing=.5u Vsub V1=0 V2=3.3 TR=150ps TF=150ps PW=200ps PER=5ns 100  $\Xi$ 

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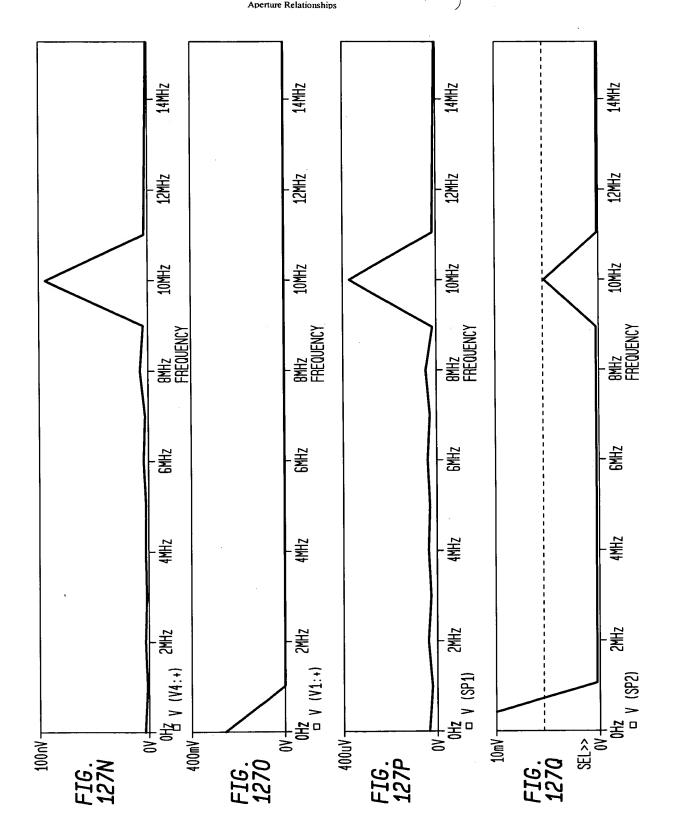
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Inventors: Sorrells et al.
Tel. No.: 202-371-2600 For: Method and System for Down-Converting an Electromagnetic Signal, Transforms for Same, and Aperture Relationships A1:(1.0000G, 5.3091m) A2:(818.000M, 11.646u) DIFF(A):(182.000M, 5.2974m) 1.00GHz FREQUENCY 1.00GHz FREQUENCY 0.98GHz 0.946Hz 0.946Hz 0.946Hz FIG. 127L SEL>> 0.926Hz 0.926Hz 10mV 10mV FIG. 127M FIG. 127J

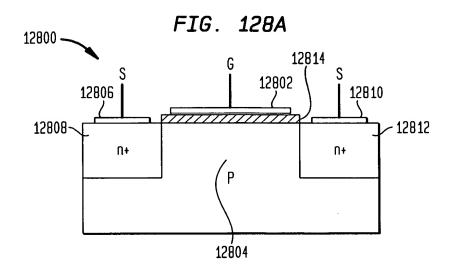
Replacement Sheet

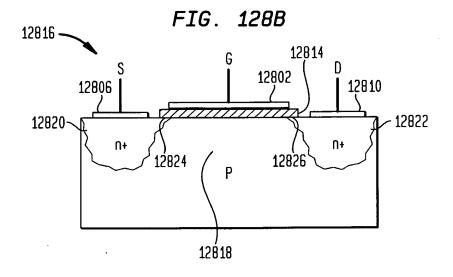
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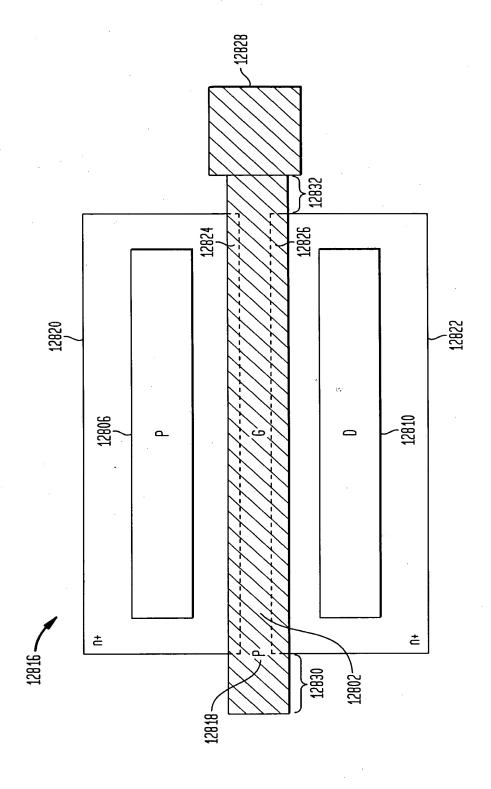
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Appl. No. 09/550,644; Filed: Apr 14, 2000
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Electromagnetic Signal, Transforms for Same, and
Aperture Relationships



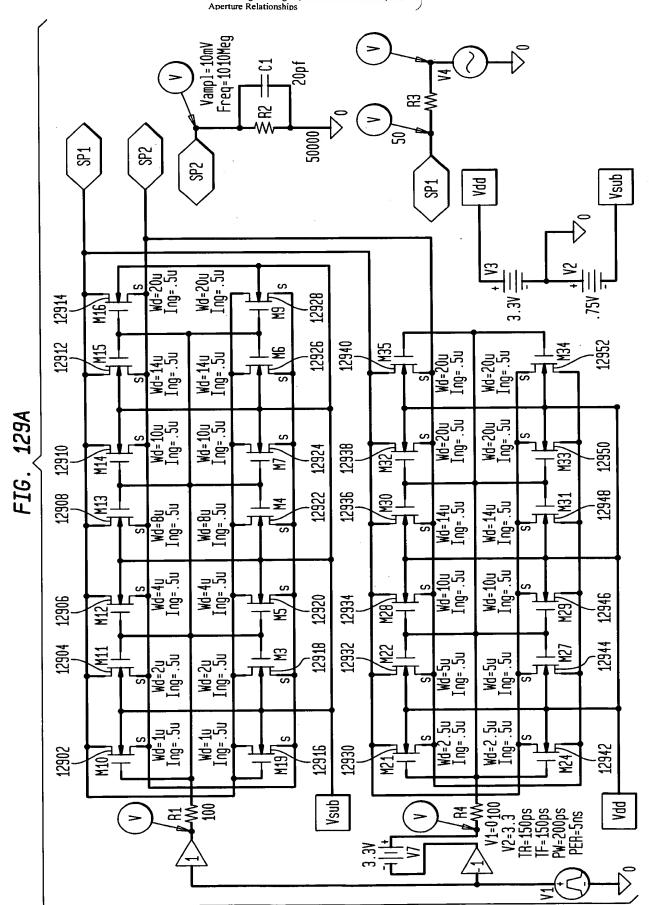


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Dkt No. 1744.0010009; Group Unit: 2688
Inventors: Sorrells et al.
Tel. No.: 202-371-2600
For: Method and System for Down-Converting an
Electromagnetic Signal, Transforms for Same, and
Aperture Relationships

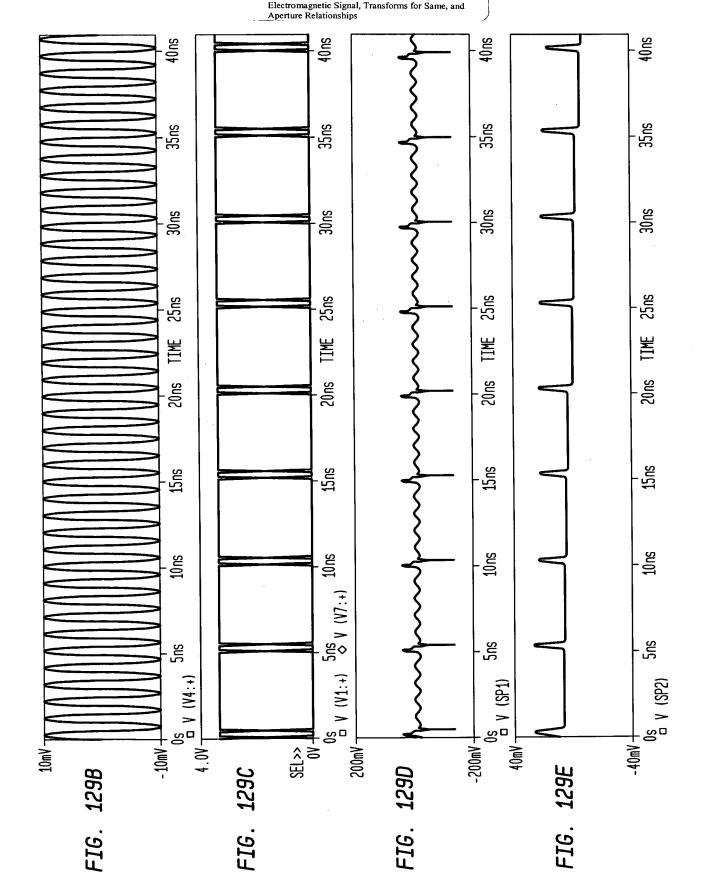




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Dkt No. 1744.0010009; Group Unit: 2688
Inventors: Sorrells et al.
Tel. No.: 202-371-2600
For: Method and System for Down-Converting an
Electromagnetic Signal, Transforms for Same, and



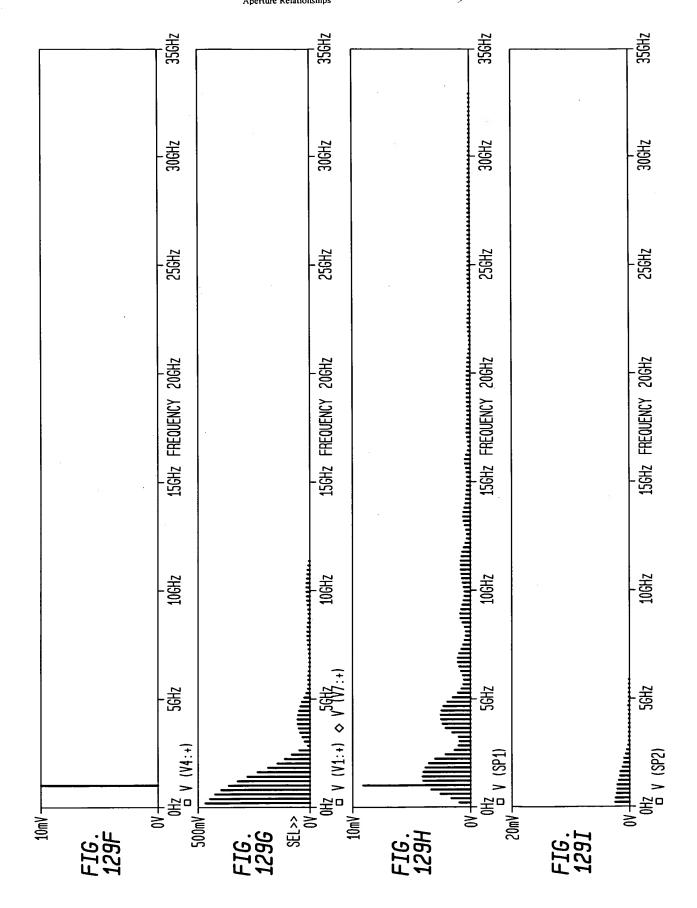
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Dkt No. 1744.0010009; Group Unit: 2688
Inventors: Sorrells et al.
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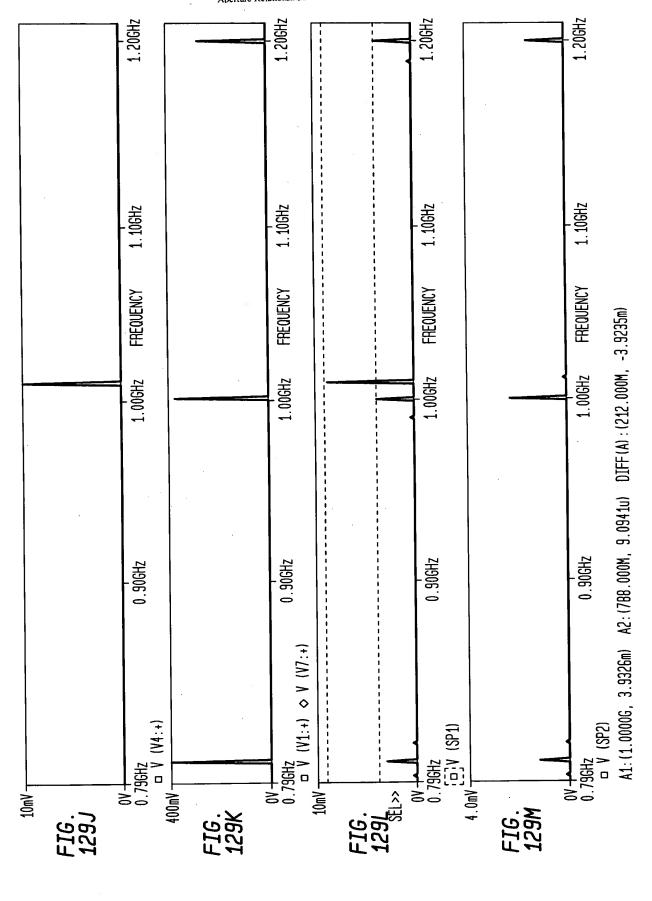
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Inventors: Sorrells et al.
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For: Method and System for Down-Converting an
Electromagnetic Signal, Transforms for Same, and
Aperture Relationships

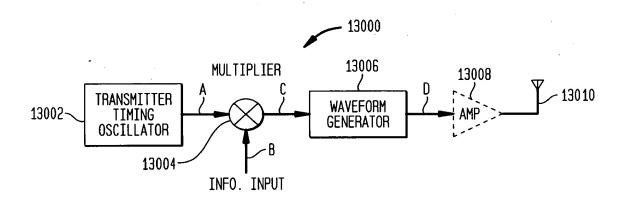


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Inventors: Sorrells et al.
Tel. No.: 202-371-2600
For: Method and System for Down-Converting an
Electromagnetic Signal, Transforms for Same, and
Aperture Relationships 20MHz 20MHz 20MHz 20MHZ 15MHz 15MHz 15MHz 15MHz 10MHz Frequency 10MHz Frequency 10MHz Frequency SMT2 SMH2 SMH2 0V+ 0Hz 0 (V4:+) 200n/ <sub>T</sub> - 200m/ 10mV-

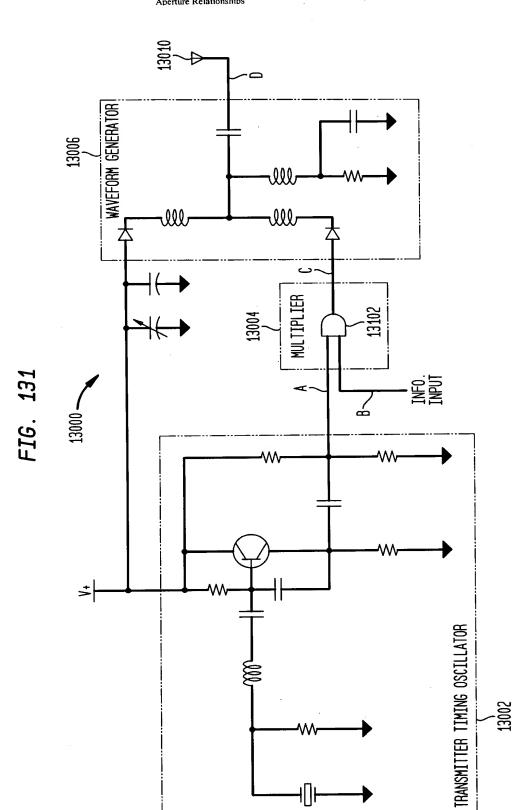
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FIG. 130



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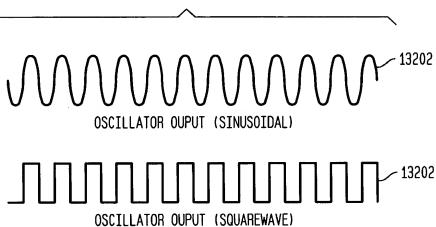
Replacement Sheet

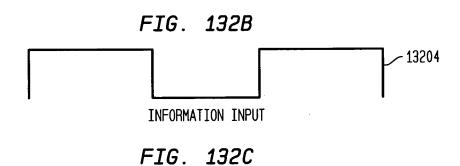
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Appl. No. 09/550,644; Filed: Apr 14, 2000
Dkt No. 1744.0010009; Group Unit: 2688
Inventors: Sorrells et al.

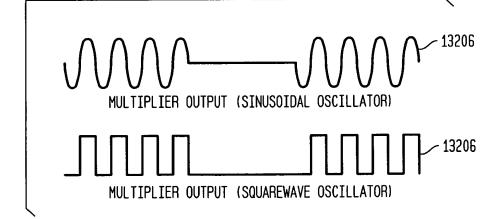
Tel. No.: 202-371-2600

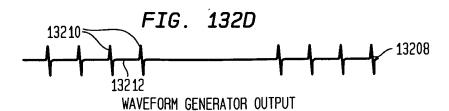
For: Method and System for Down-Converting an Electromagnetic Signal, Transforms for Same, and Aperture Relationships



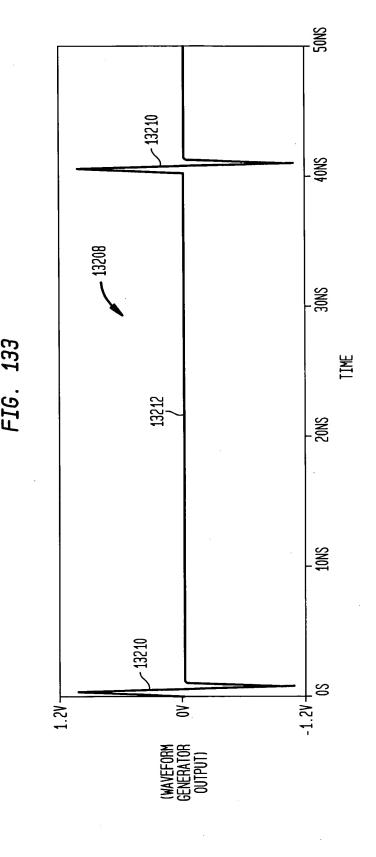




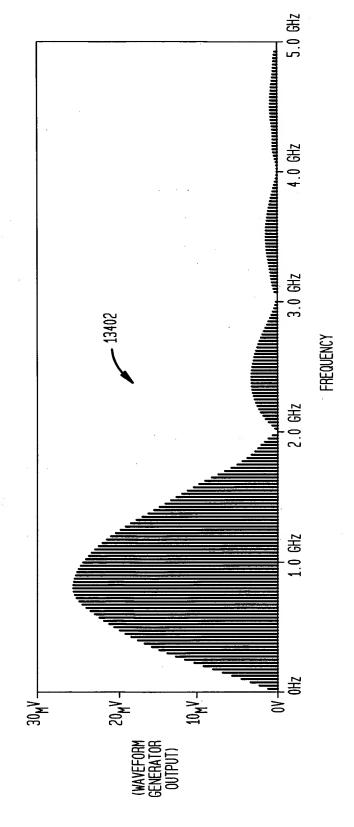




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Aperture Relationships

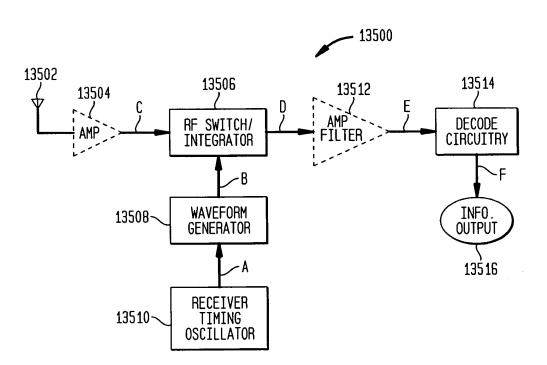


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Inventors: Sorrells et al. Tel. No.: 202-371-2600

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FIG. 135



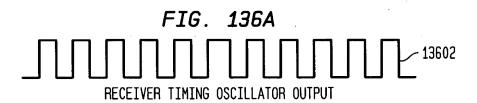
Replacement Sheet

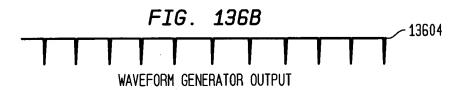
Sheet 173 of 284 Appl. No. 09/550,644; Filed: Apr 14, 2000 Dkt No. 1744.0010009; Group Unit: 2688

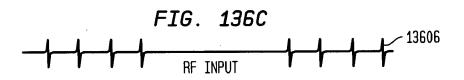
Inventors: Sorrells et al. Tel. No.: 202-371-2600

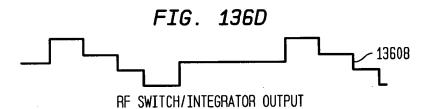
For: Method and System for Down-Converting an Electromagnetic Signal, Transforms for Same, and

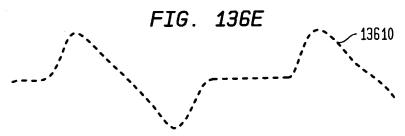
Aperture Relationships



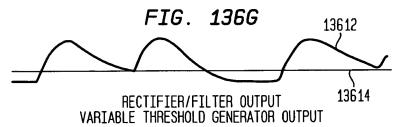


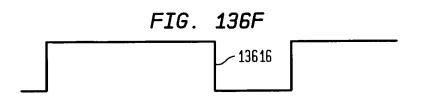




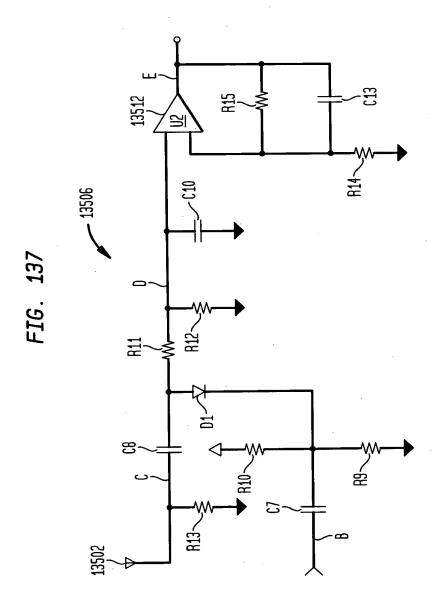




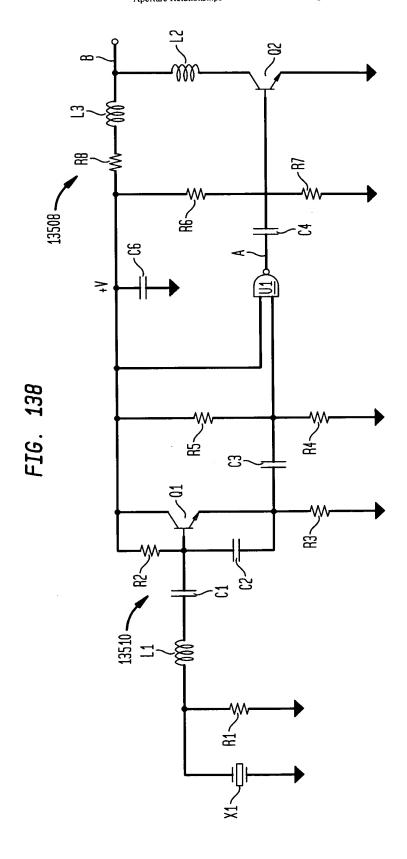




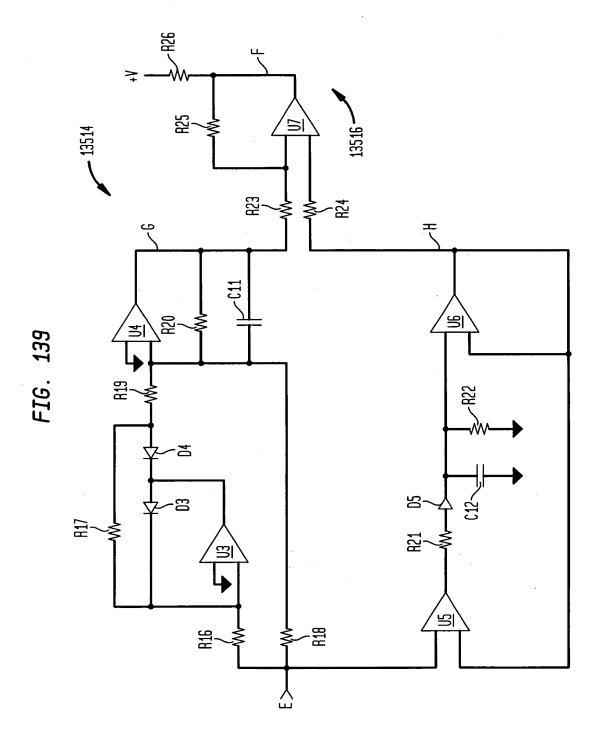
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Dkt No. 1744.0010009; Group Unit: 2688
Inventors: Sorrells et al.
Tel. No.: 202-371-2600
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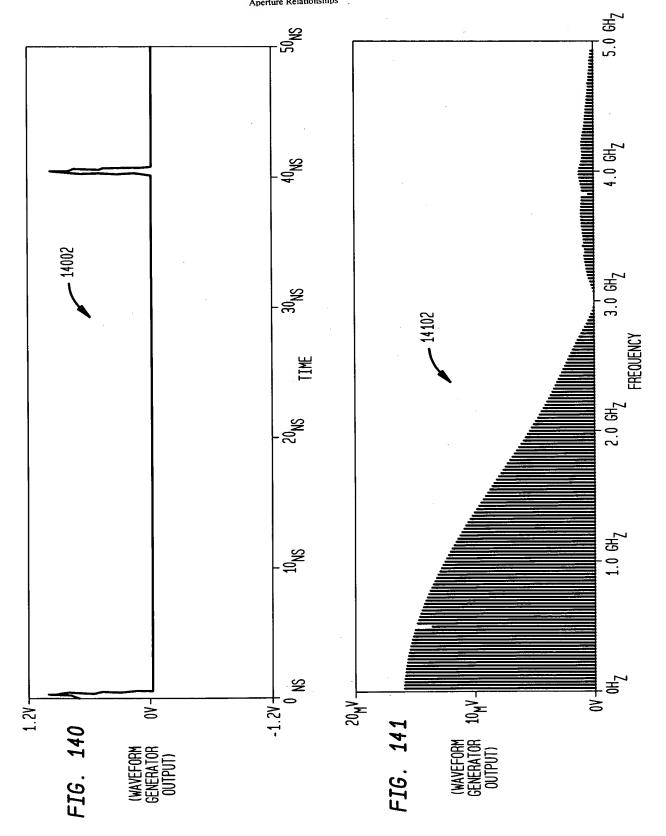
Replacement Sheet
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Dkt No. 1744.0010009; Group Unit: 2688
Inventors: Sorrells et al.
Tel. No.: 202-371-2600
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Electromagnetic Signal, Transforms for Same, and
Aperture Relationships

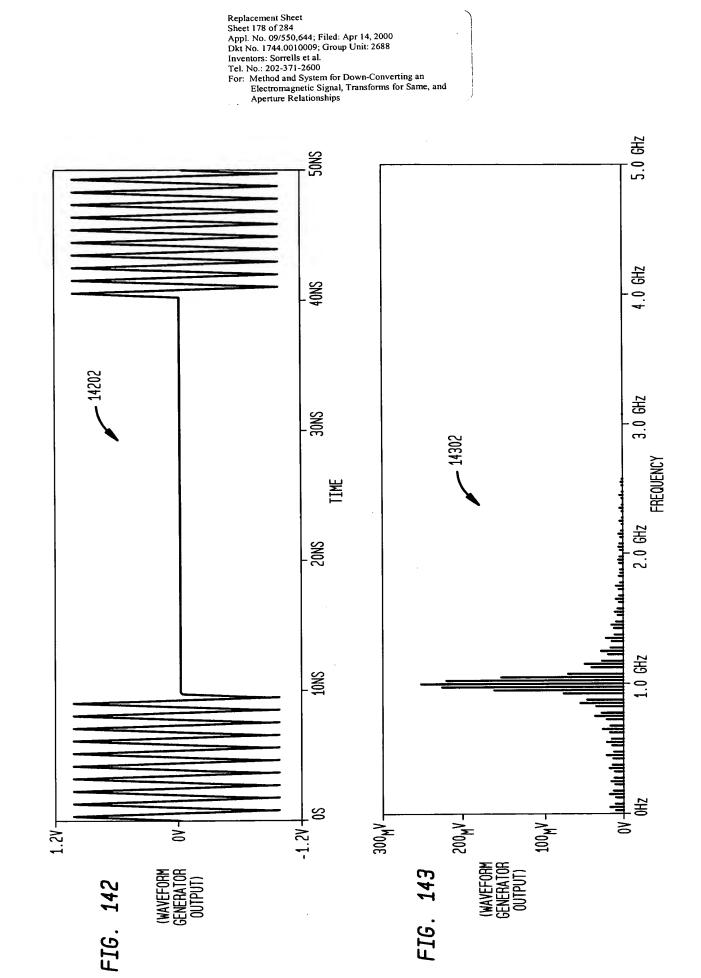


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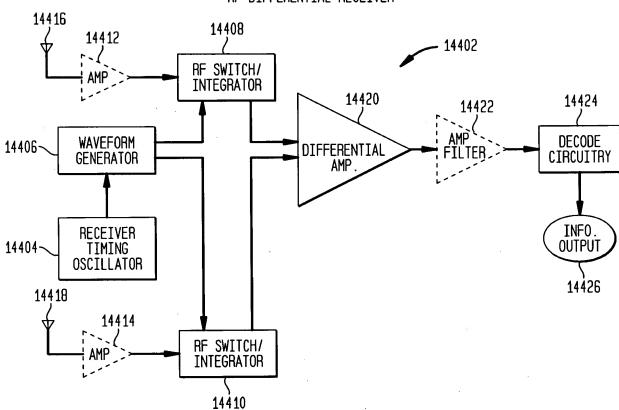
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FIG. 144

## RF DIFFERENTIAL RECEIVER



Replacement Sheet

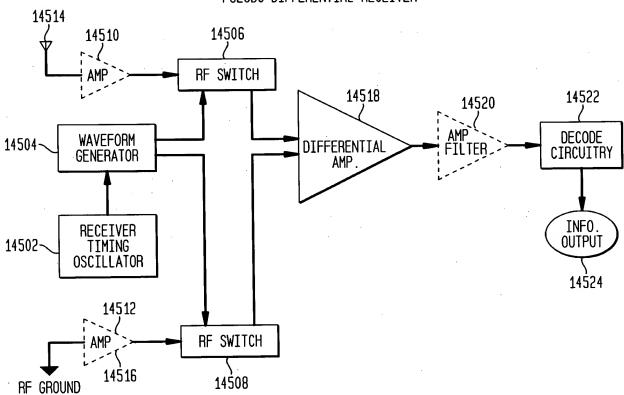
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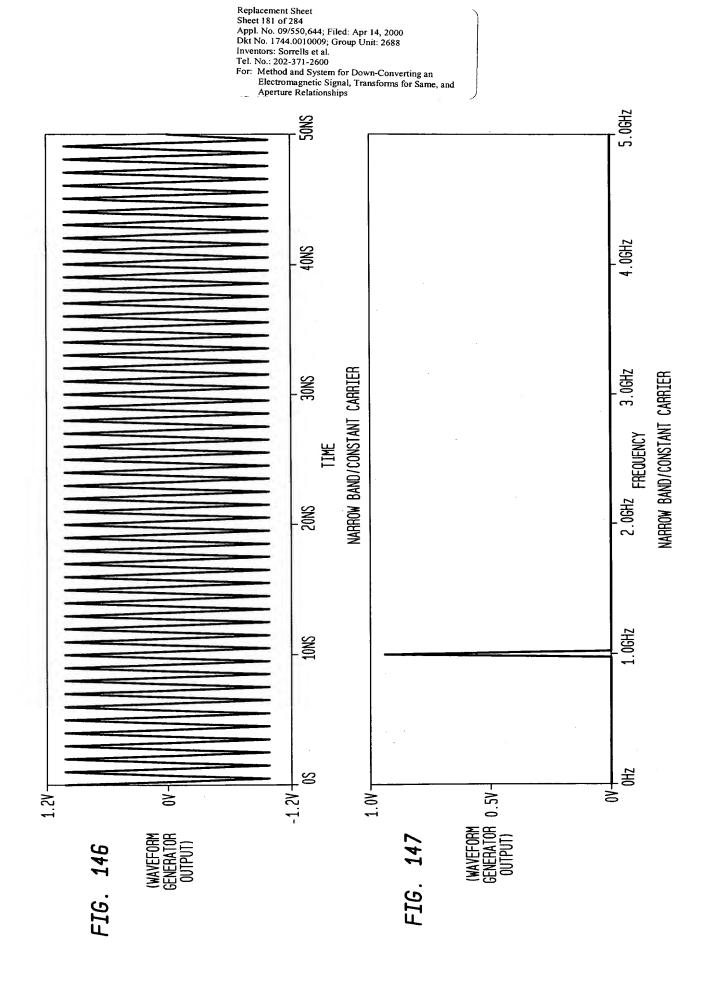
Appl. No. 09/550,644; Filed: Apr 14, 2000
Dkt No. 1744.0010009; Group Unit: 2688
Inventors: Sorrells et al.
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FIG. 145

## PSEUDO DIFFERENTIAL RECEIVER





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Tel. No.: 202-371-2600

FIG. 148

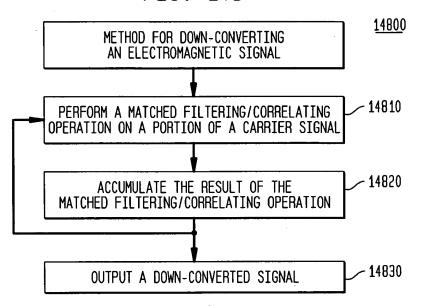
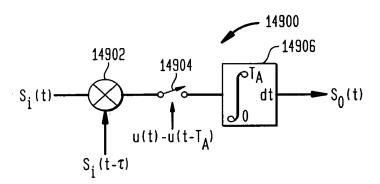


FIG. 149



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Aperture Relationships

FIG. 150

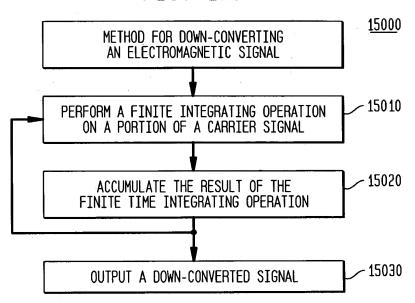
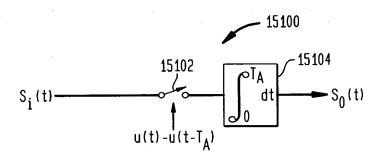


FIG. 151



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Inventors: Sorrells et al.

FIG. 152

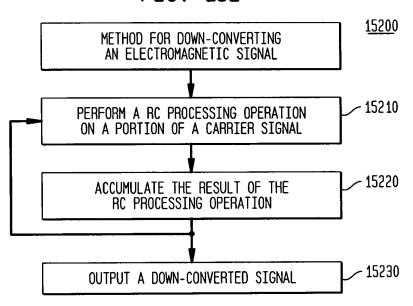
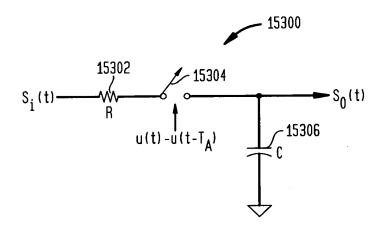


FIG. 153



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FIG. 154

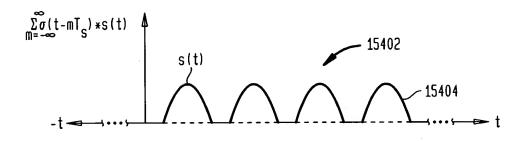
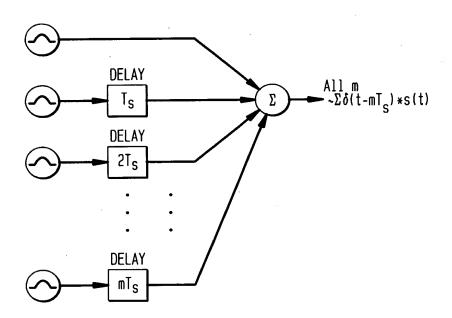


FIG. 155



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FIG. 156

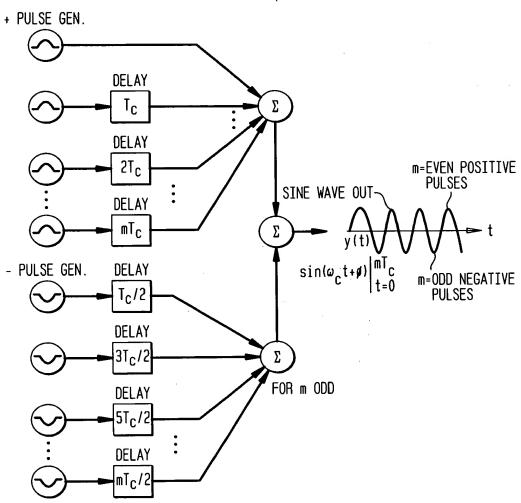
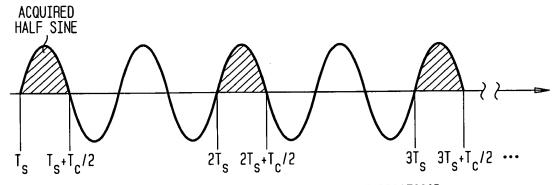
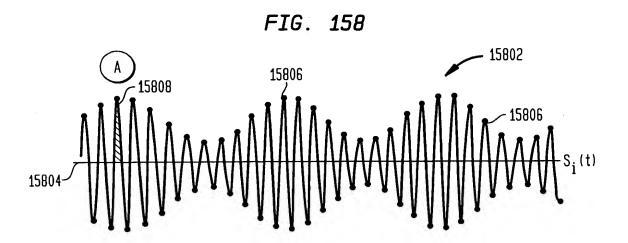


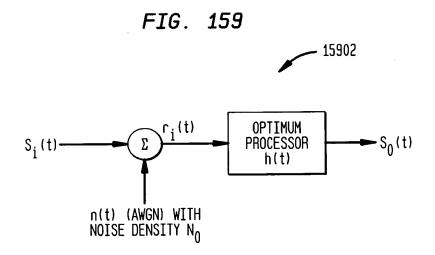
FIG. 157



CARRIER PROCESSED BY 3RD HARMONIC UFT PROCESSOR

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FIG. 160

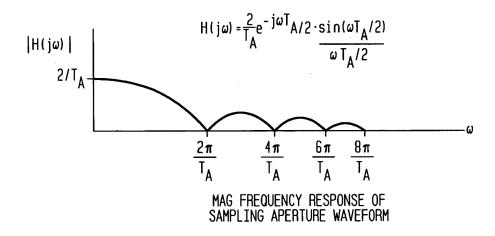
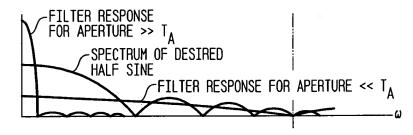


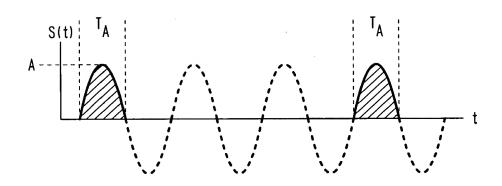
FIG. 161

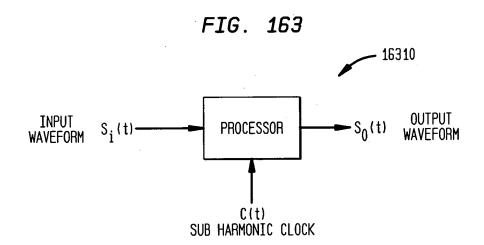


APERTURE FREQUENCY DOMAIN REPRESENTATION

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FIG. 162

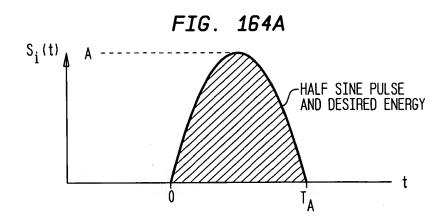


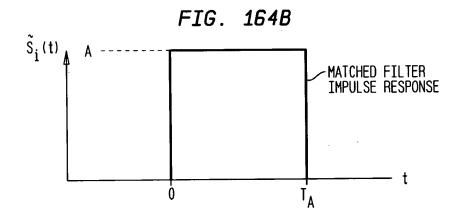


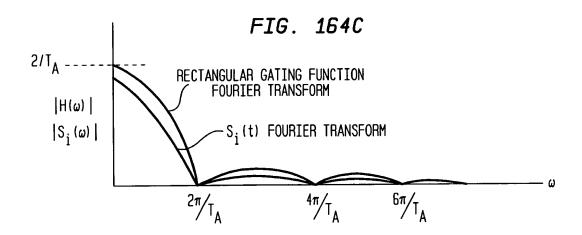
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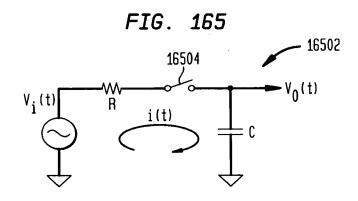
Inventors: Sorrells et al.
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For: Method and System for Down-Converting an
Electromagnetic Signal, Transforms for Same, and
Aperture Relationships

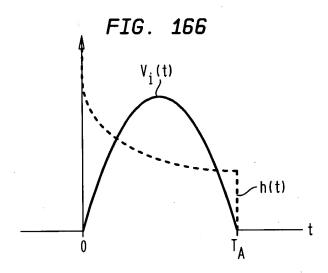


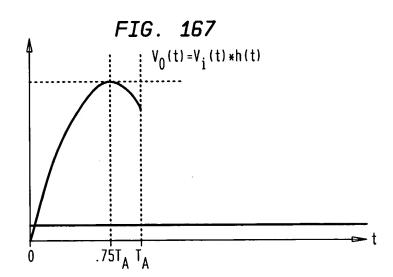




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FIG. 168 UFT OUTPUT VS. BETA FOR SIMPLE RC IMPLEMENTATION

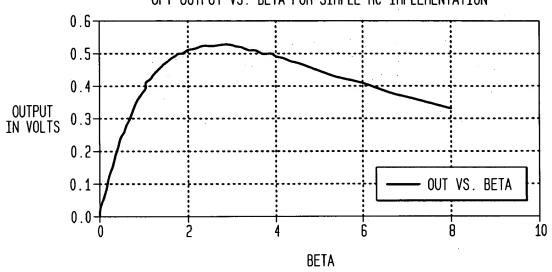


FIG. 169

UFT OUTPUT RESPONSE VS. NORMALIZED TIME WITH BETA AS A PARAMETER 1.0 BETA=.25 0.8 BETA=1.0 BETA=2.6 0.6 OUTPUT IN VOLTS BETA=3.5 0.4 0.2 0.8 0.4 0.6 1.0 0.0 0.2 1.2 TIME RELATIVE TO SINGLE APERTURE

Replacement Sheet

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FIG. 170

NORMALIZED SNR FOR MF, INT., RC UFT IMPLEMENTATIONS, No.=1, Ta=A, A=1

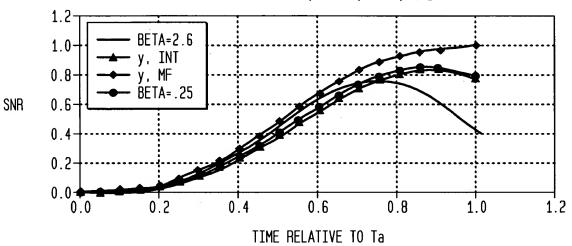
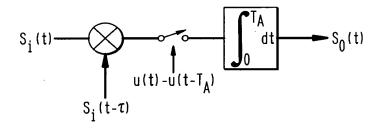


FIG. 171



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FIG. 172

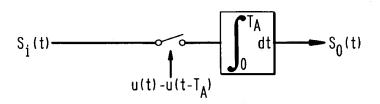
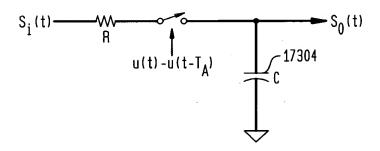


FIG. 173

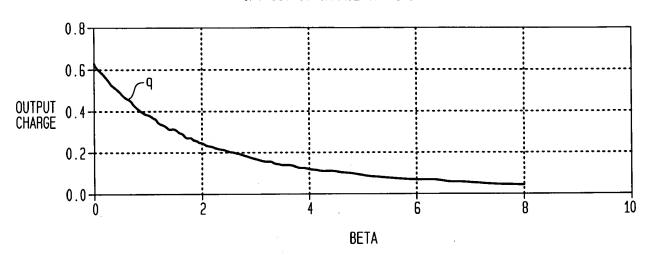


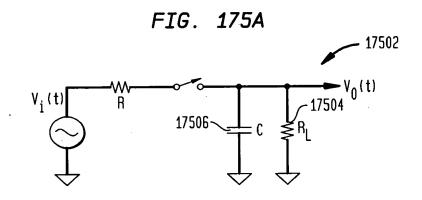
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FIG. 174
UFT OUTPUT CHARGE TRANSFER





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FIG. 175B

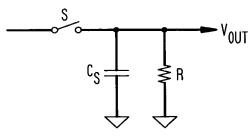


FIG. 175C

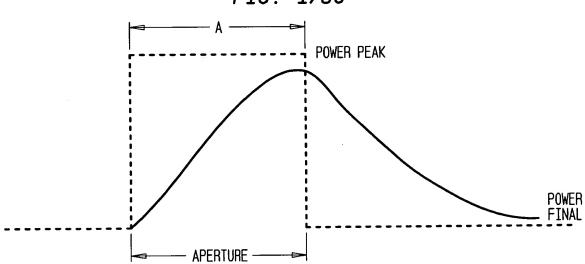
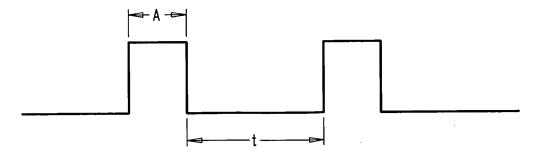


FIG. 175D



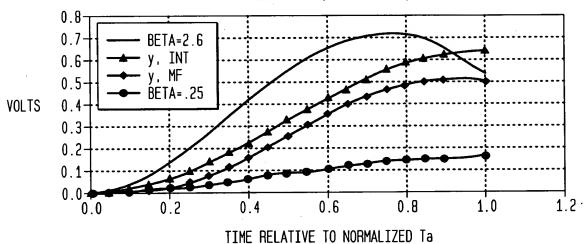
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FIG. 176

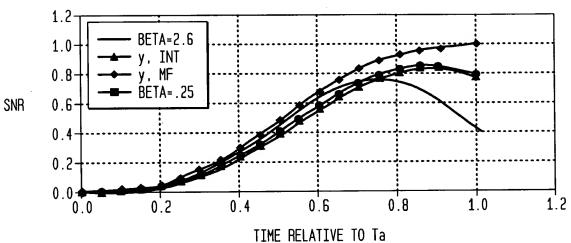
## OUTPUT VOLTAGE FOR 3 UFT PROCESSORS; MATCHED FILTER, INTEGRATOR, RC



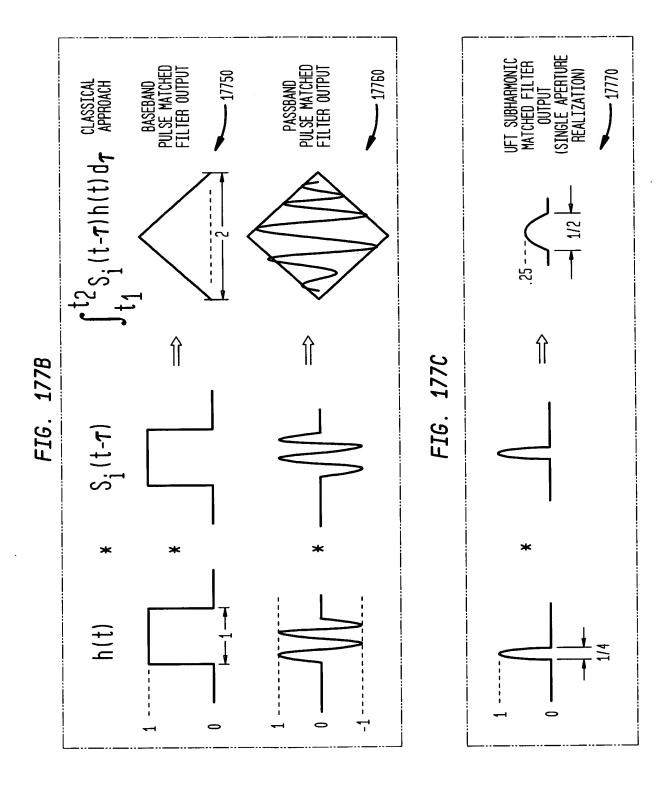
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FIG. 177A

NORMALIZED SNR FOR MF, INT., RC UFT IMPLEMENTATIONS, No.=1, Ta=1, A=1



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FIG. 177D

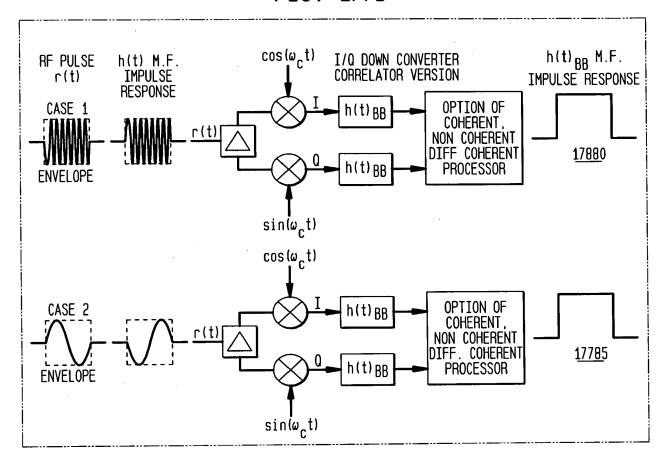
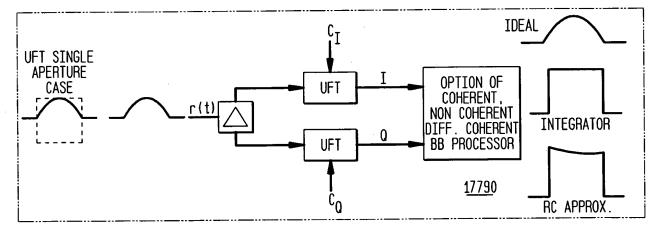


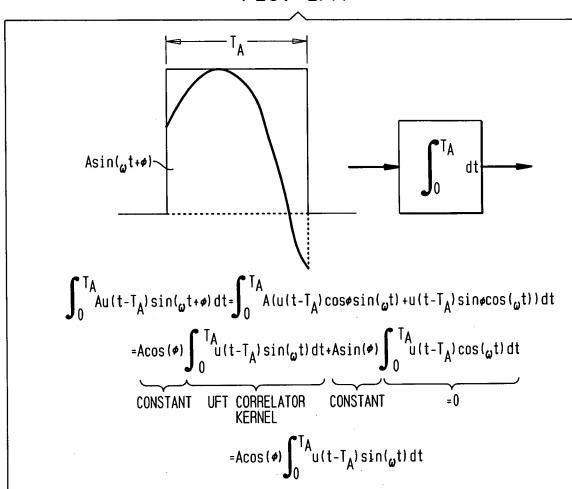
FIG. 177E



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FIG. 177F



- ·A IS CONSTANT ON A SINE TO SINE BASIS

   Ø IS CONSTANT ON A SINE TO SINE BASIS

   i.e., THE MODULATION RATE DUE TO INFORMATION FOR PHASE AND AMPLITUDE IS VERY SLOW COMPARED TO CARRIER FREQUENCY

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FIG. 178A

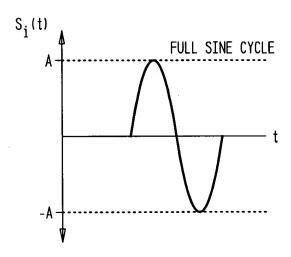
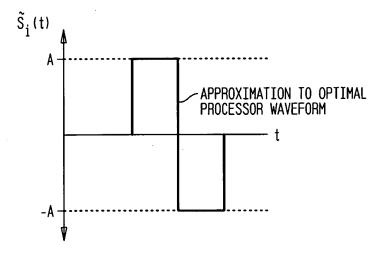
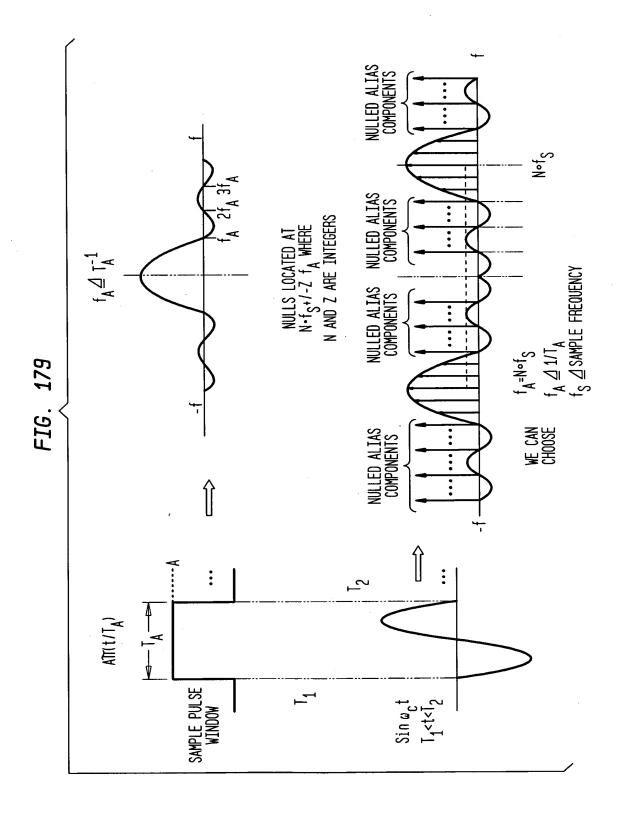


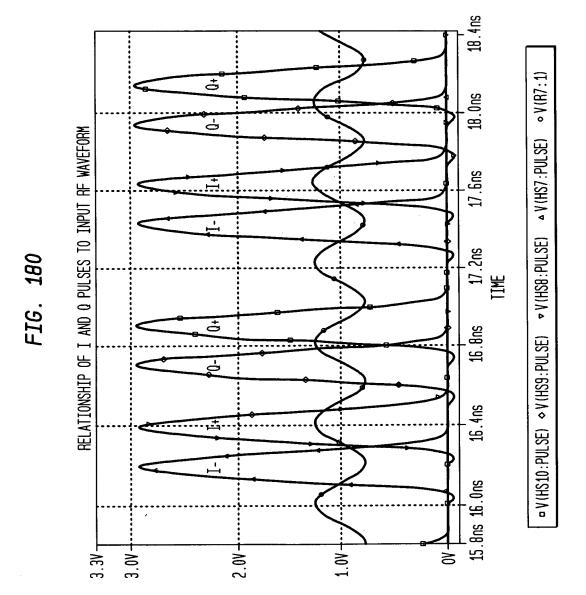
FIG. 178B



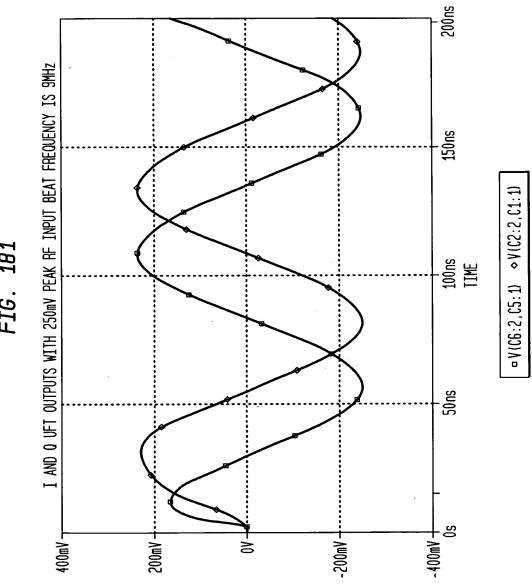
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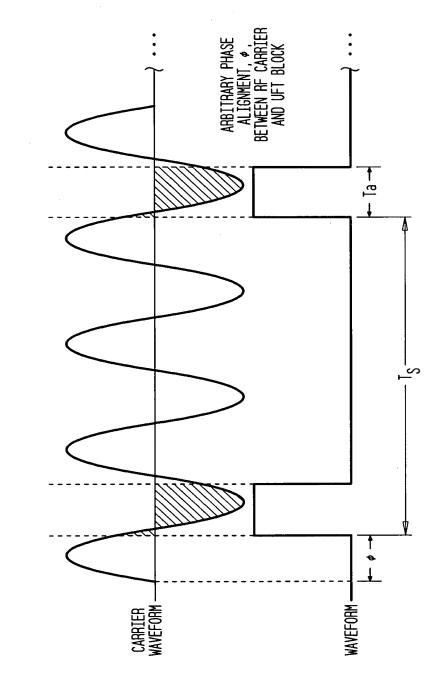
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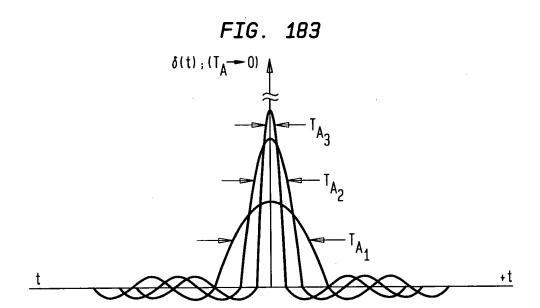
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Tel. No.: 202-371-2600
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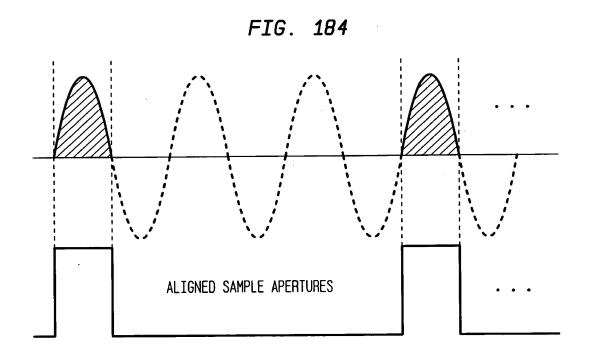


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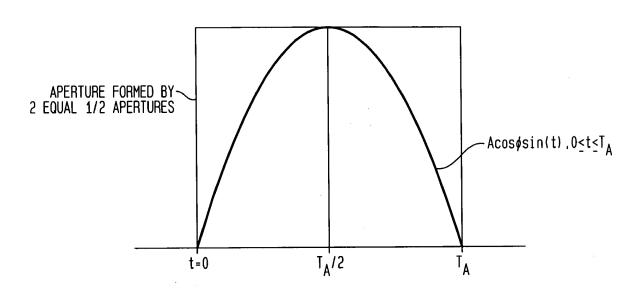


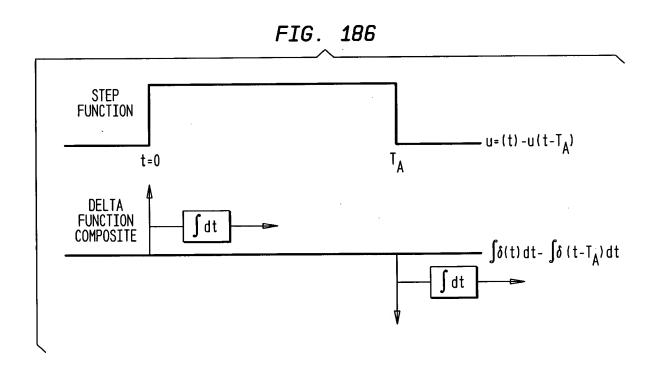


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FIG. 185





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FIG. 187

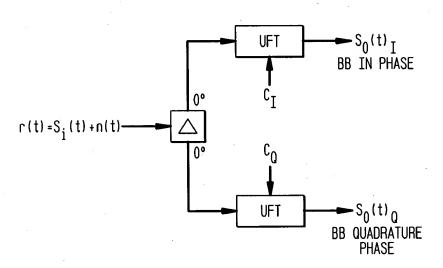


FIG. 188

$$C_{I}(t) = \sum_{m=-\infty}^{\infty} \delta(t - mT_{s}) * \rho_{c}(t) = \sum_{m=-\infty}^{\infty} \rho(t - mT_{s})$$

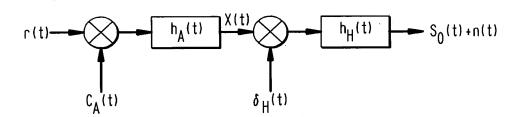
$$C_{I}(t) = \sum_{m=-\infty}^{\infty} (u(t) - u(t - T_{A})) * \delta(t - mT_{s})$$

$$C_{Q}(t) = \sum_{m=-\infty}^{\infty} (u[t - T_{A}/2] - u[t - 3T_{A}/2]) * \delta(t - (mT_{s} + T_{A}/2))$$

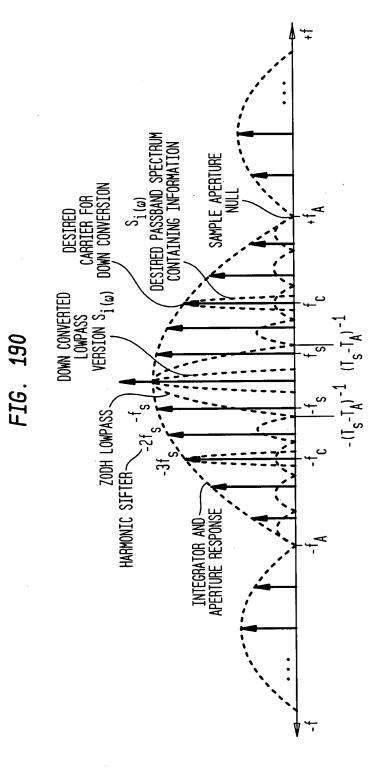
$$\frac{18804}{18806}$$

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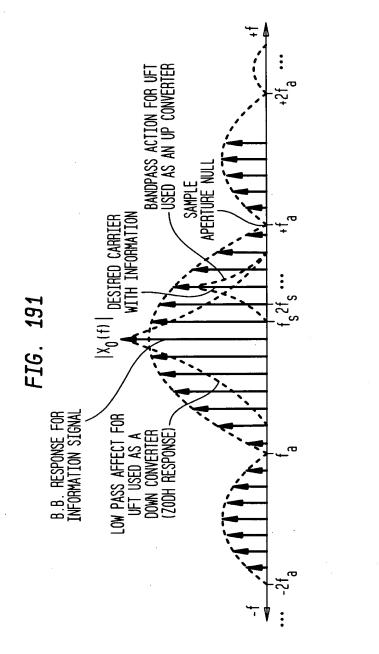
FIG. 189



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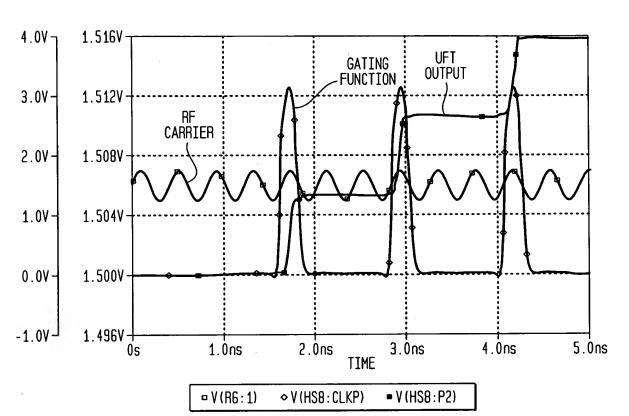
s(t) + n(t) -

FIG. 192

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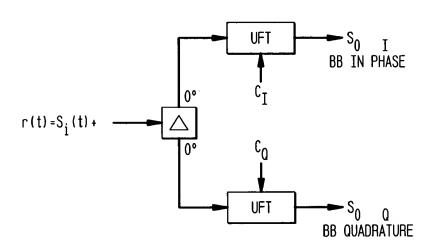
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FIG. 193

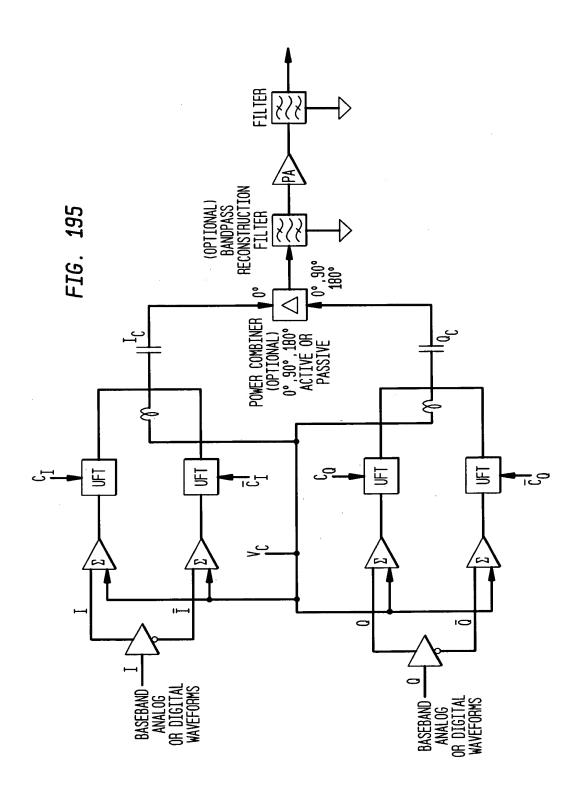


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FIG. 194

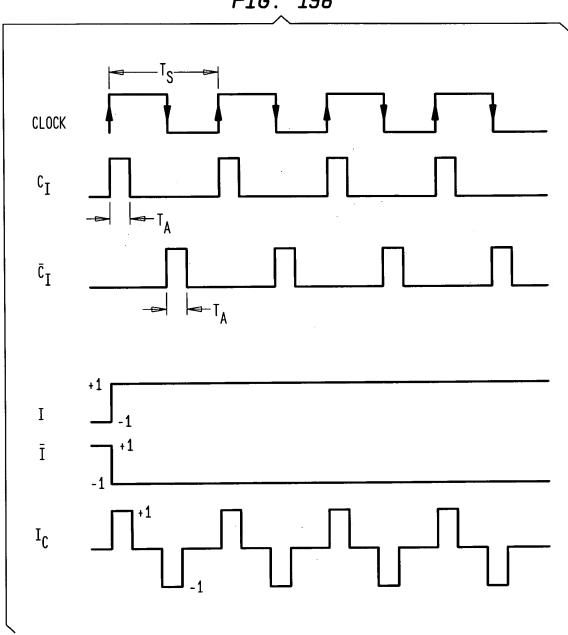


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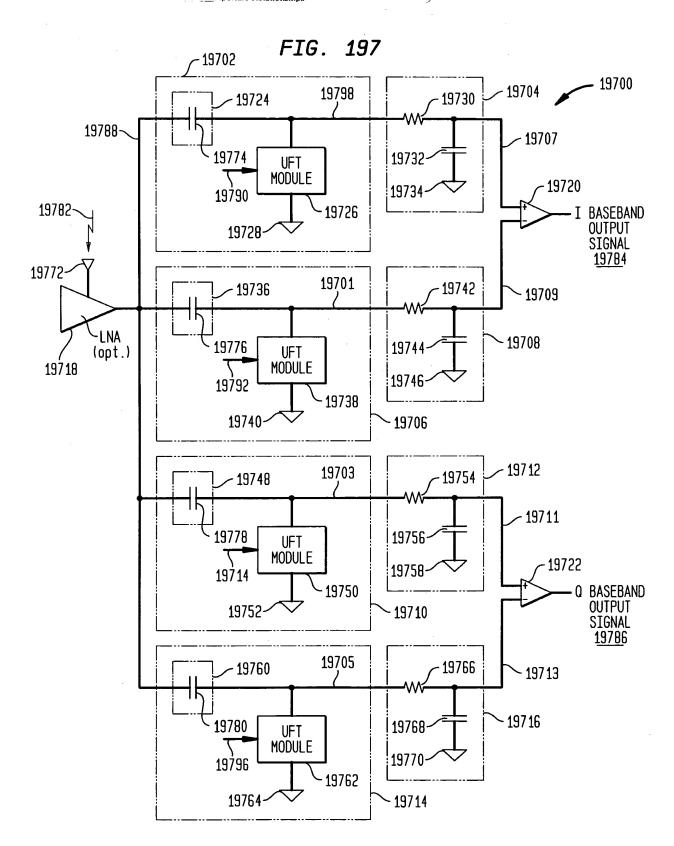
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FIG. 196



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\_\_Aperture Relationships

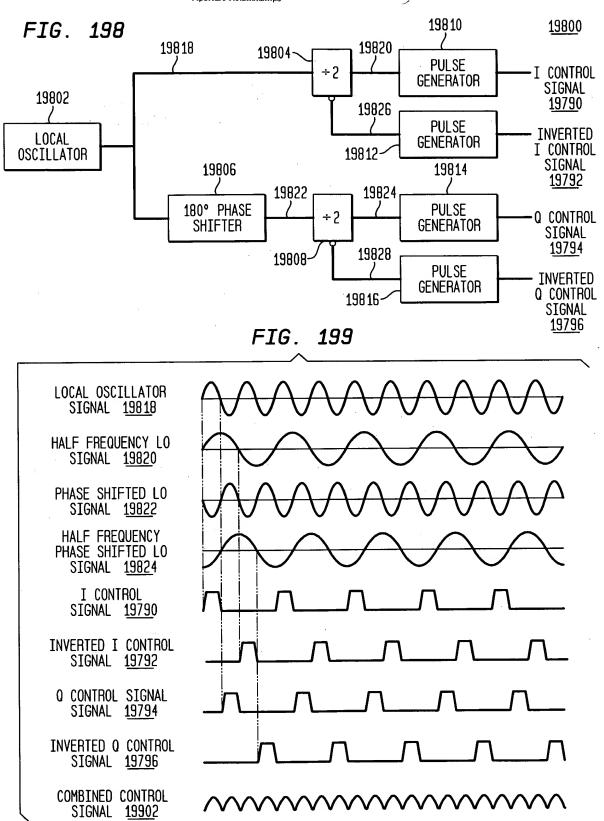


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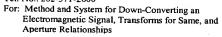
Appl. No. 09/550,644; Filed: Apr 14, 2000 Dkt No. 1744.0010009; Group Unit: 2688

Inventors: Sorrells et al. Tel. No.: 202-371-2600

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Inventors: Sorrells et al.
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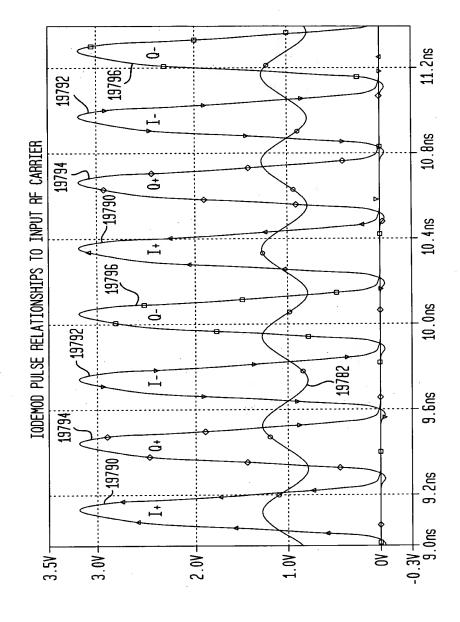
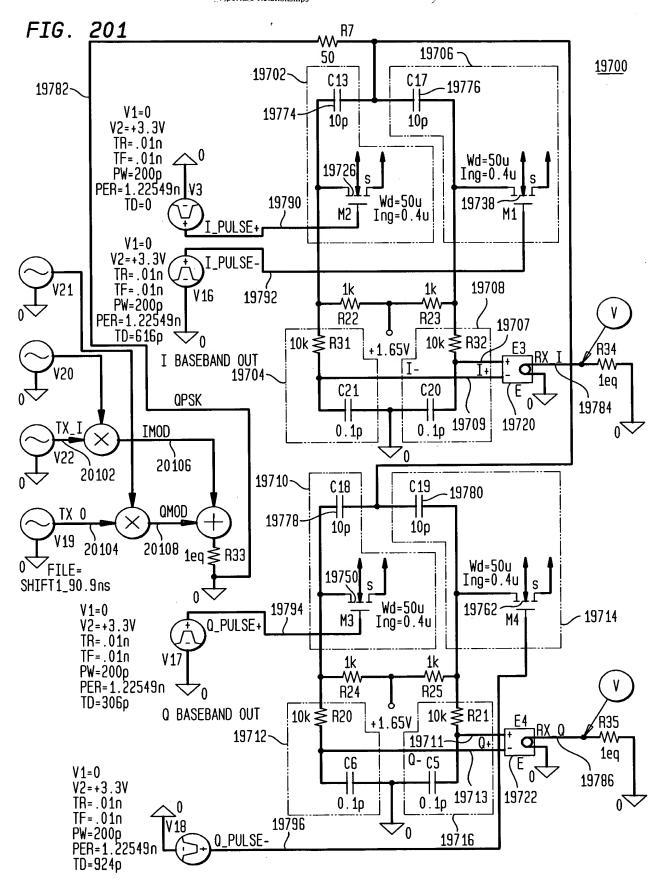


FIG. 200

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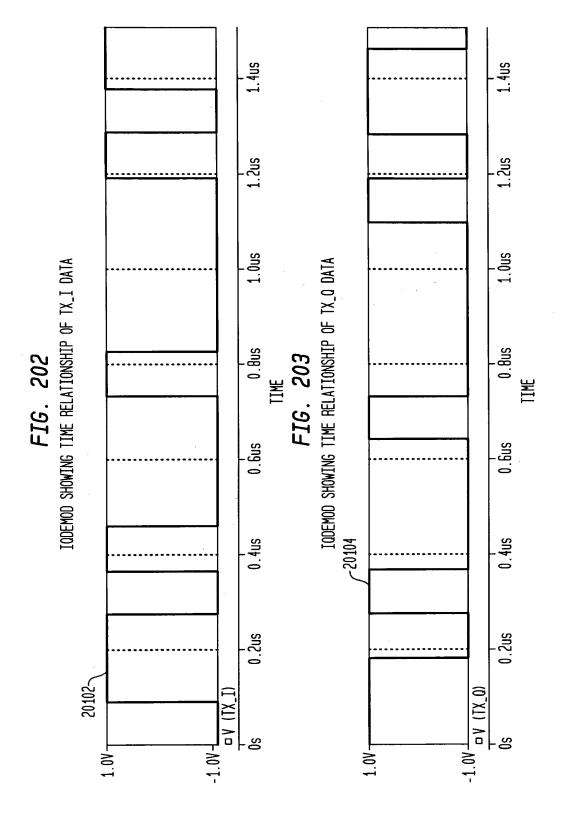
Appl. No. 09/550,644; Filed: Apr 14, 2000 Dkt No. 1744.0010009; Group Unit: 2688

Inventors: Sorrells et al.
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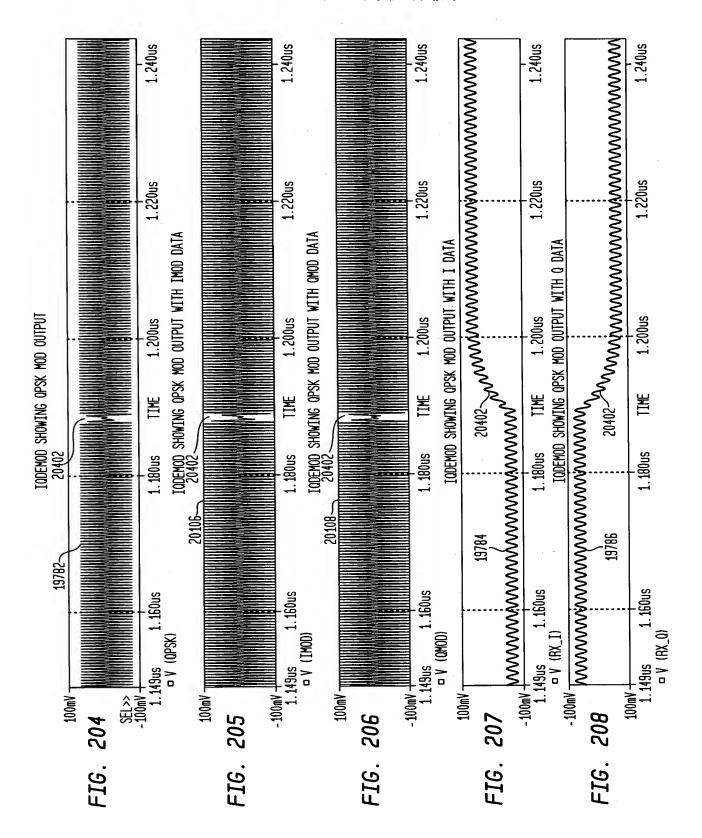
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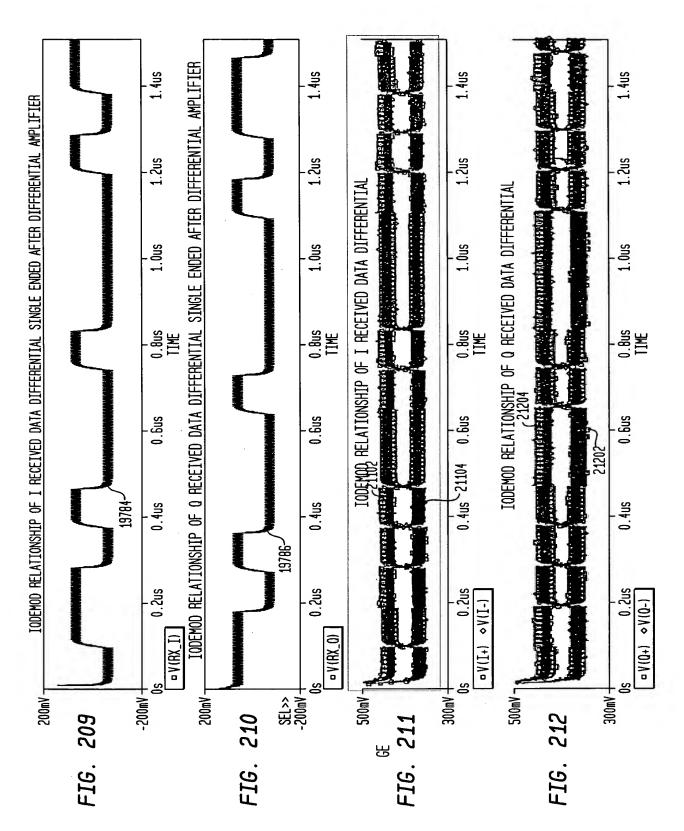
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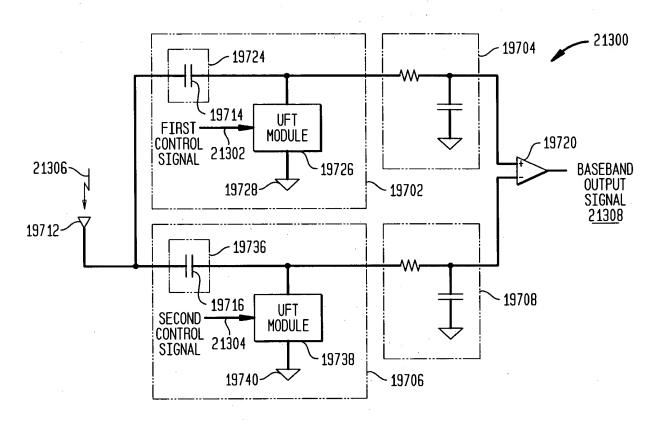




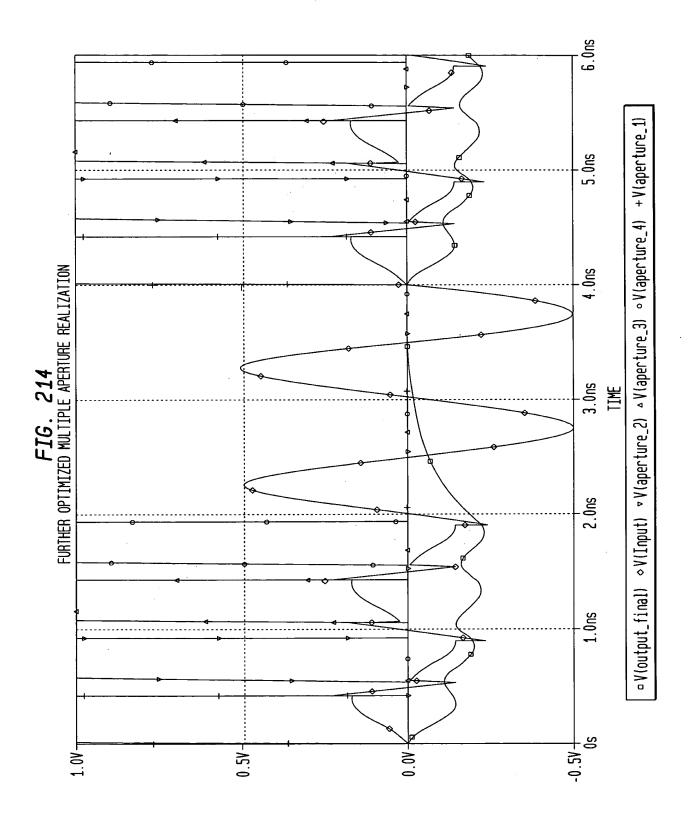
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FIG. 213



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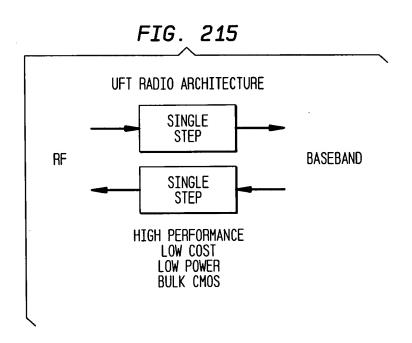
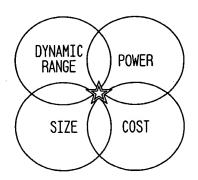


FIG. 216 WIRELESS TRADE-OFF DESIGN CONCERNS



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### FIG. 217

# NOISE FIGURE CALCULATIONS BASED ON RMS VOLTAGE AND CURRENT NOISE SPECIFICATIONS

ENTER, THE VOLTAGE NOISE DENSITY,  $\mathbf{e}_{n},$  AND THE CURRENT NOISE DENSITY,  $\mathbf{i}_{n},$  FOR THE AMPLIFIER CHOSEN:

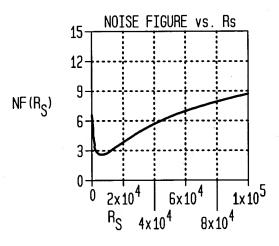
$$e_n:=6 \cdot 10^{-9}$$
 V/sqrt(Hz)  
 $i_n:=1 \cdot 10^{-12}$  A/sqrt(Hz)

ENTER THE SOURCE RESISTANCE DRIVING THE AMPLIFIER:

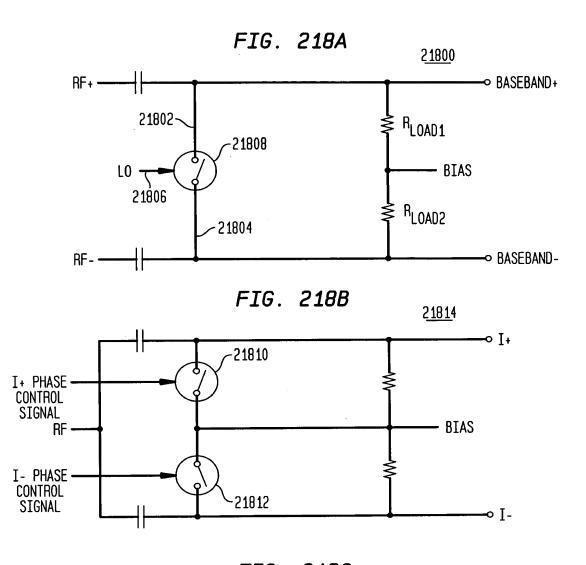
$$\text{PARALELL} (x,y) := \frac{x \cdot y}{x + y} \qquad \text{NF} (R_S) := 20 \cdot \log \left( \sqrt{\frac{e_n^2 + 4 \cdot K \cdot T \cdot R_S + i_n^2 \cdot R_S^2}{4 \cdot K \cdot T \cdot R_S}} \right)$$

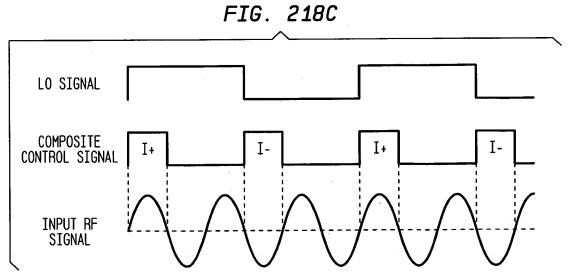
IF WE PLOT NOISE FIGURE VERSUS SOURCE RESISTANCE WE CAN GET AN IDEA OF WHAT IS THE OPTIMUM SOURCE RESISTANCE.
IT IS NOT NECESSARILY THE LOWEST RESISTANCE!

$$R_S := 100,200...100 \cdot 10^3$$



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FIG. 218D

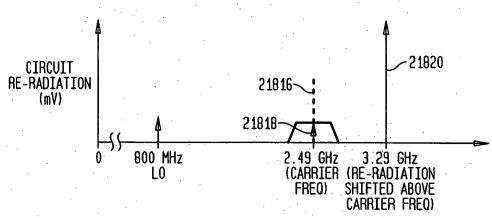


FIG. 218F

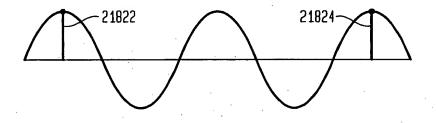
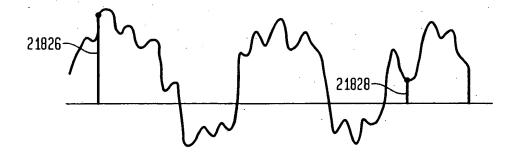
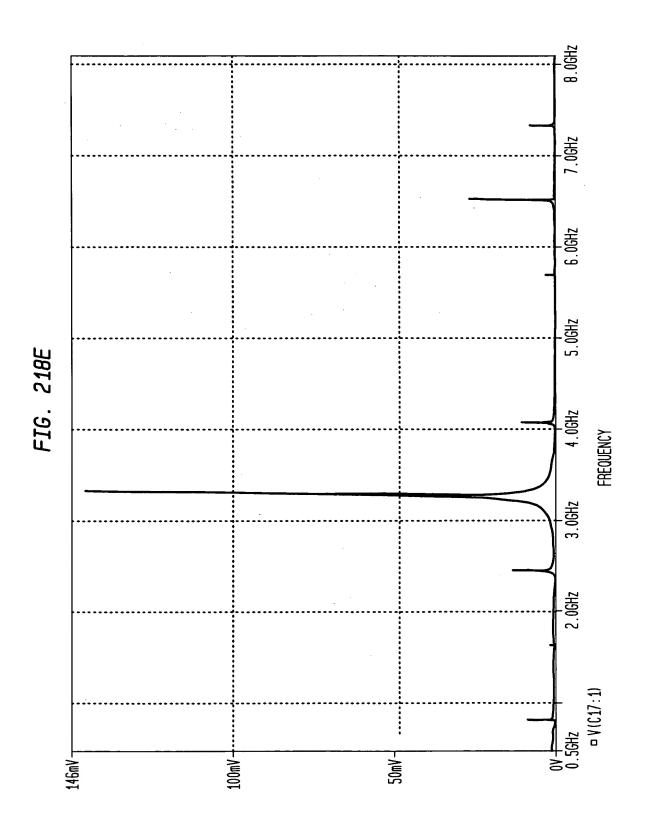


FIG. 218G



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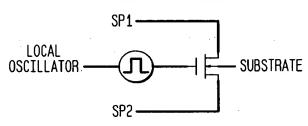
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Inventors: Sorrells et al. Tel. No.: 202-371-2600

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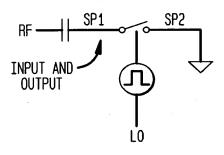
# FIG. 219

## IC CONCEPTUAL SCHEMATIC



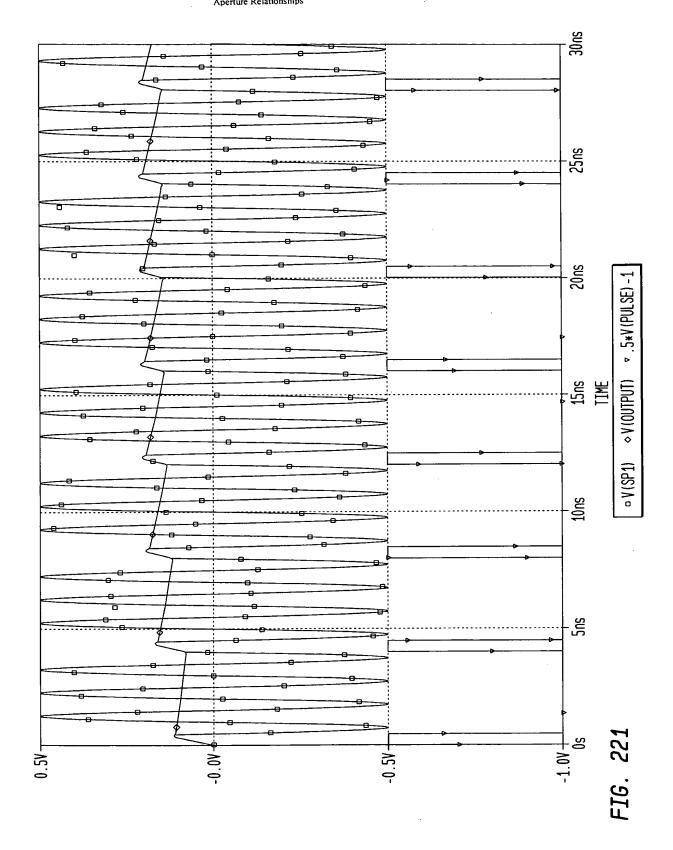
# FIG. 220

#### BASIC ARCHITECTURE



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## FIG. 222

#### DC EQUATIONS

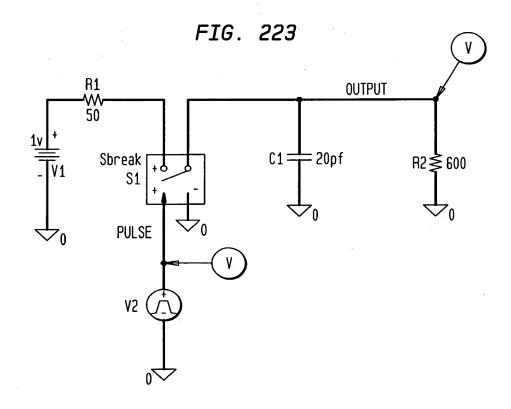
Vin=V• Rout

 $Vc = Vin - (Vin - Vinit) \cdot exp(\frac{-tc}{Rin \cdot C})$ 

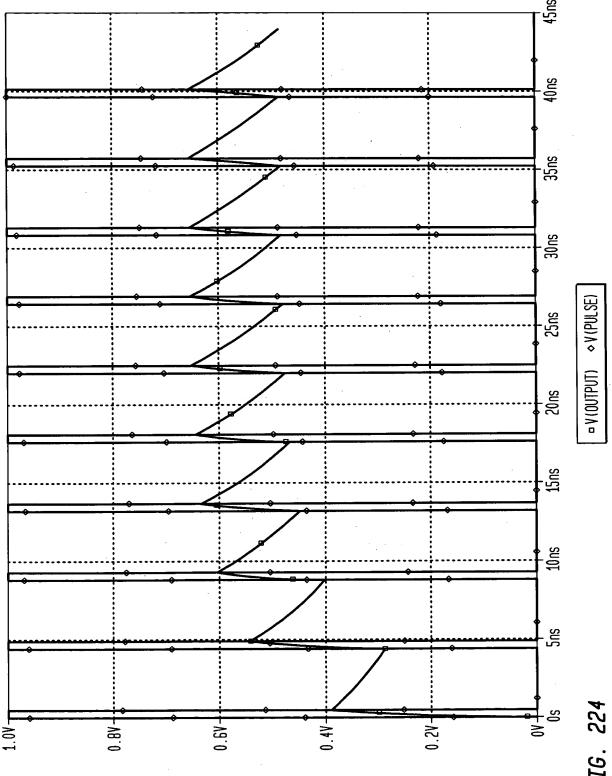
 $Vd=Vc \cdot exp(\frac{-td}{Rout \cdot C})$ 

DEFINITIONS:

Rin - INPUT RESISTANCE
Rout - OUTPUT RESISTANCE
C - CAPACITOR
tc - CHARGE TIME OR APERATURE
td - DISCHARGE TIME OR LO PERIOD-tc
V - INPUT VOLTAGE
Vinit -INITIAL CAPACITOR VOLTAGE
Vc - FINAL CHARGE CAPACITOR VOLTAGE
Vd - FINAL DISCHARGE CAPACITOR VOLTAGE

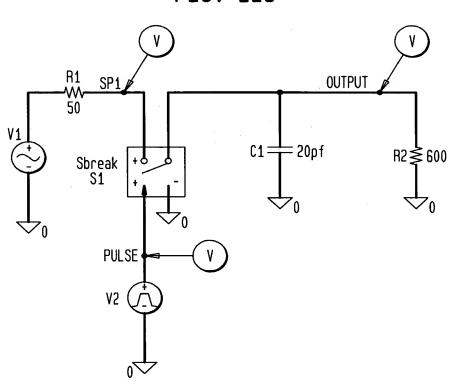


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Inventors: Sorrells et al.
Tel. No.: 202-371-2600
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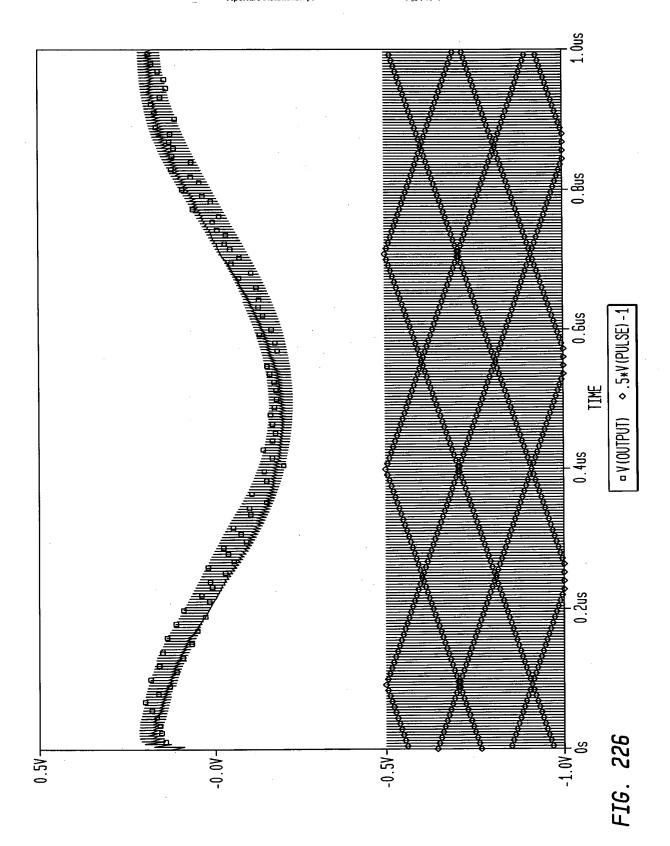


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Inventors: Sorrells et al.
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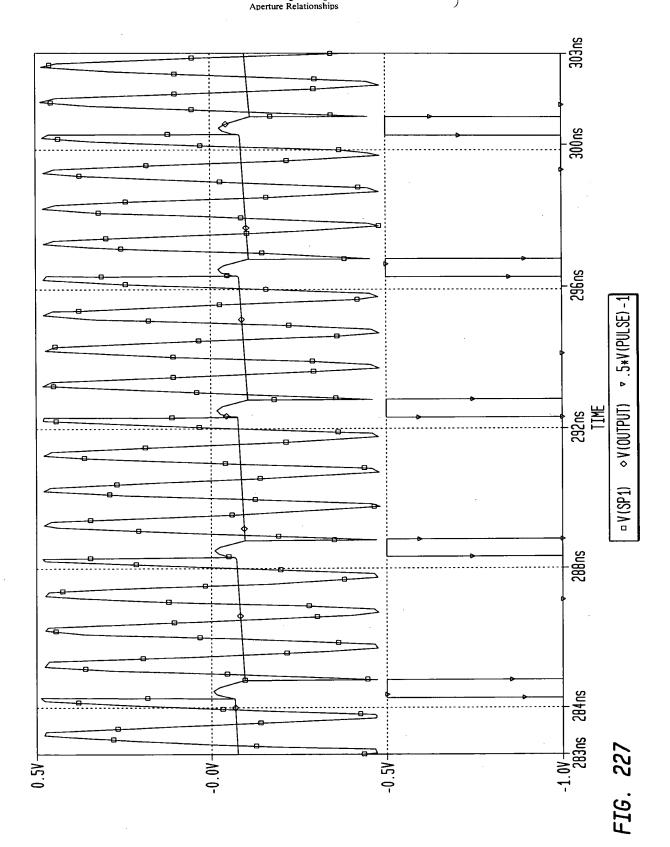
FIG. 225



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## FIG. 228

#### CHARGE TRANSFER

#### **DEFINITIONS:**

q=CHARGE IN COULOMBS C=CAPACITANCE IN FARADS V=VOLTAGE IN VOLTS A=INPUT SIGNAL AMPLITUDE

EQUATION A

 $\Delta\,q(t)\,\text{EXPRESSES}$  THE CHANGE IN CHARGE ACROSS CAPACITOR C DURING APERTURE T. AS CAN BE SEEN, WHEN APERTURE T TENDS TOWARDS 0,  $\Delta\,q(t)$  TENDS TOWARDS 0.

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### FIG. 229

USING THE SUM TO PRODUCT TRIGONOMETRIC IDENTITY,

$$\sin(\alpha) - \sin(\beta) = 2 \cdot \sin(\frac{\alpha - \beta}{2}) \cdot \cos(\frac{\alpha + \beta}{2})$$

IDENTITY 1

**EQUATION 1 CAN BE RE-WRITTEN AS:** 

$$\Delta q(t) = 2 \cdot C \cdot A \cdot \sin \left[ \frac{t - (t - T)}{2} \right] \cdot \cos \left[ \frac{t + (t - T)}{2} \right]$$

$$\Delta q(t) = 2 \cdot C \cdot A \cdot \sin \left(\frac{1}{2} \cdot T\right) \cdot \cos \left(t - \frac{1}{2} \cdot T\right)$$

EQUATION B

THE sin TERM IN EQUATION B IS A FUNCTION OF APERTURE T ONLY. IT IS EASILY SEEN THAT  $\Delta q(t)$  WILL OBTAIN A MAXIMUM VALUE WHEN T IS EQUAL TO AN ODD MULTIPLE OF  $\pi$ i.e.,  $\pi$ 3  $\pi$ 5  $\pi$ . THEREFORE, CAPACITOR C EXPERIENCES THE GREATEST CHANGE IN CHARGE WHEN THE APERTURE HAS A VALUE OF  $\pi$  OR A TIME INTERVAL REPRESENTATIVE OF 180 DEGREES OF THE INPUT SINUSOID. CONVERSELY, WHEN T IS EQUAL TO  $2\pi$ ,  $4\pi$ ,  $6\pi$ ....MINIMAL CHARGE IS TRANSFERRED.

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Inventors: Sorrells et al. Tel. No.: 202-371-2600

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FIG. 230

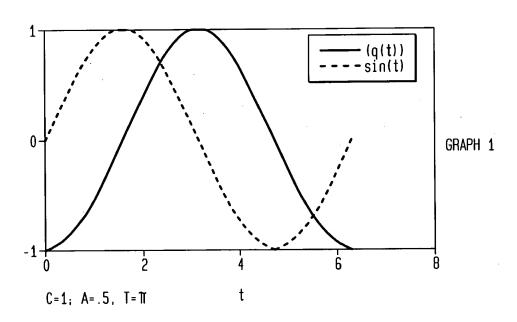
SOLVING FOR q(t) BY INTEGRATING EQUATION A ALLOWS THE CHARGE ON C WITH RESPECT TO TIME TO BE GRAPHED ON THE SAME AXIS AS THE INPUT SINUSOID sin(t).

$$q(t) = \int C \cdot A \cdot (\sin(t) - \sin(t-T)) dt$$

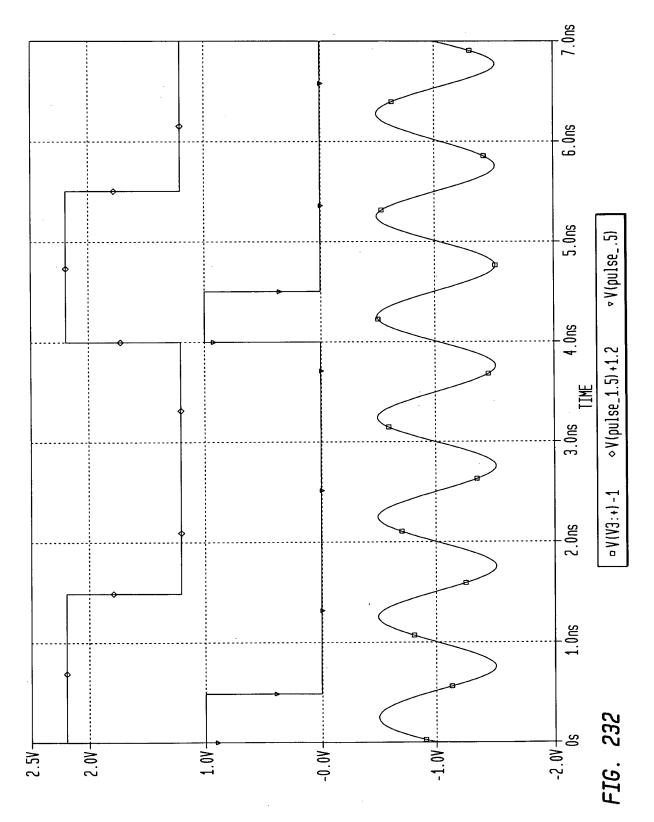
$$q(t) = -\cos(t) \cdot C \cdot A + \cos(t-T) \cdot C \cdot A$$

$$q(t) = C \cdot A \cdot (\cos(t-T) - \cos(t))$$
 EQUATION C

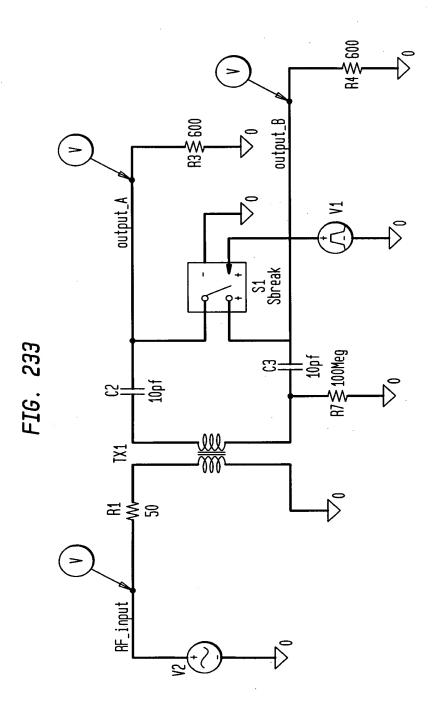
FIG. 231



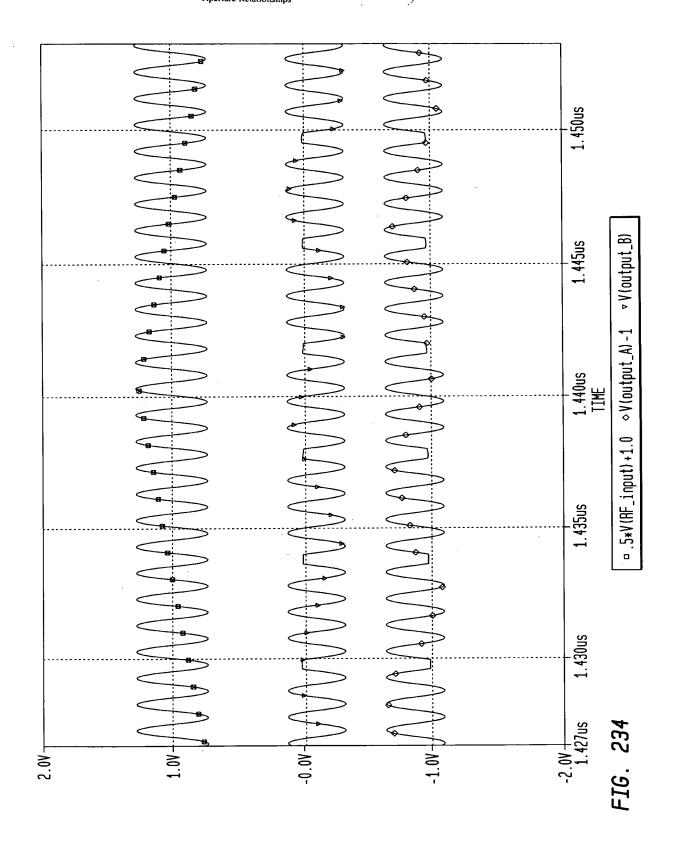
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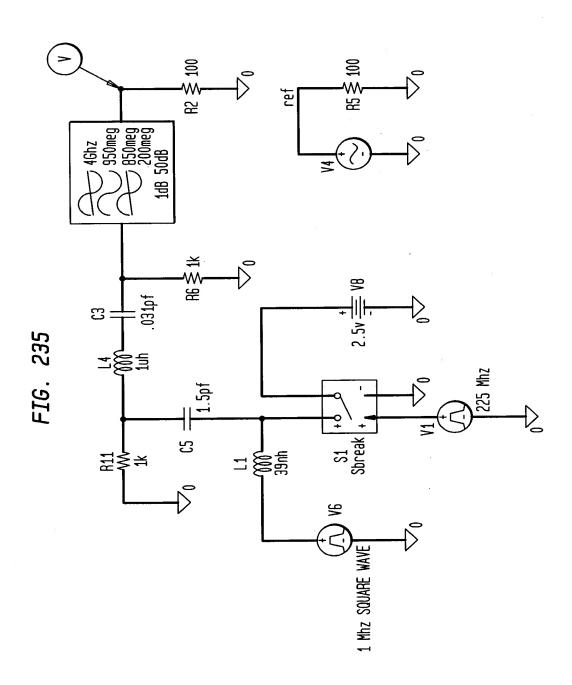


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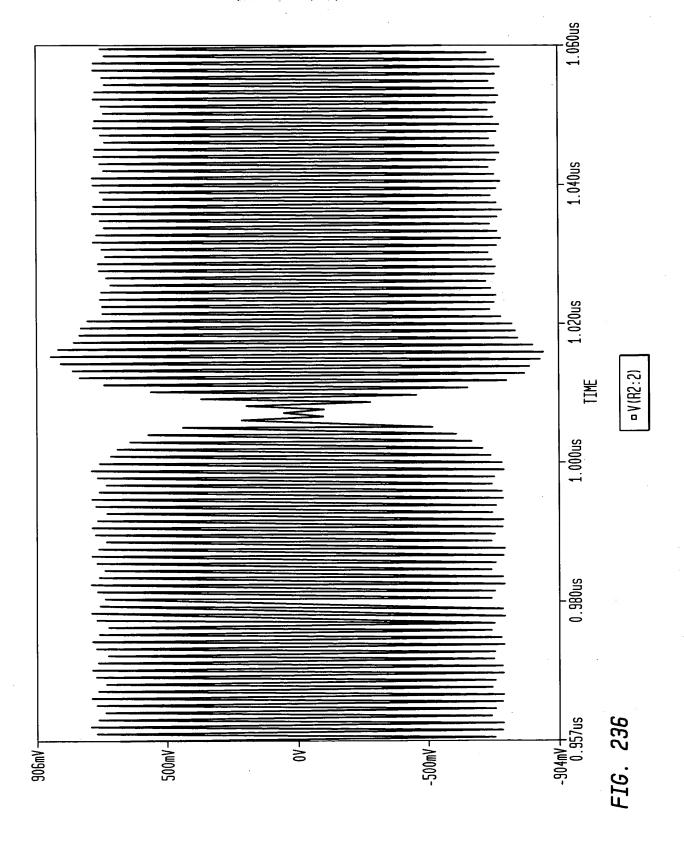


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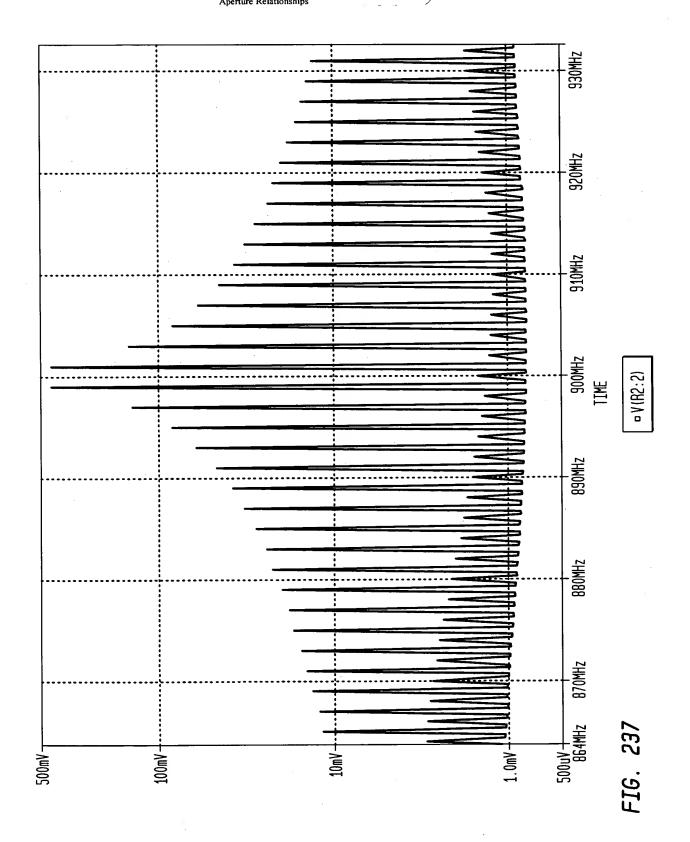
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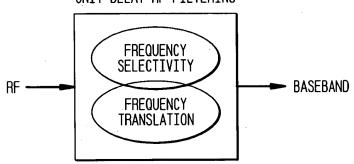


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Electromagnetic Signal, Transforms for Same, and Aperture Relationships

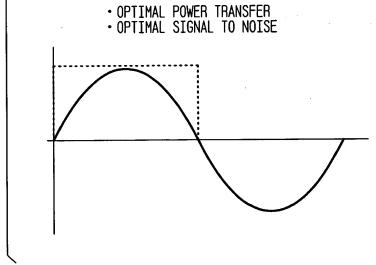
FIG. 238

#### UNIT DELAY RF FILTERING

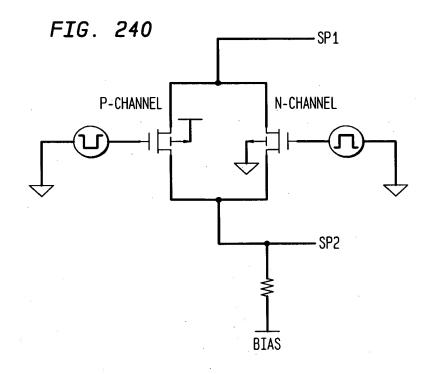


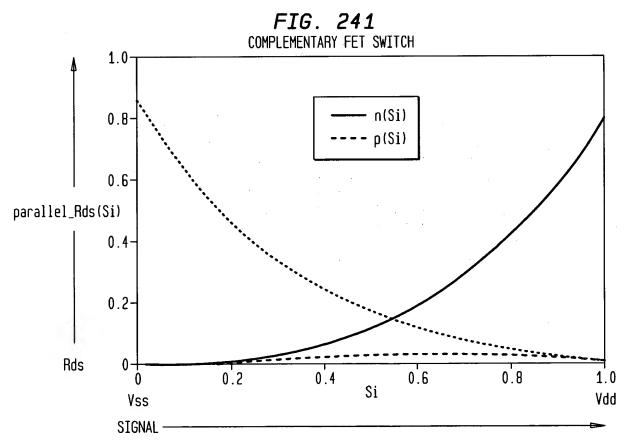
# FIG. 239

### MULTIPLE CRITERIA-ONE SOLUTION



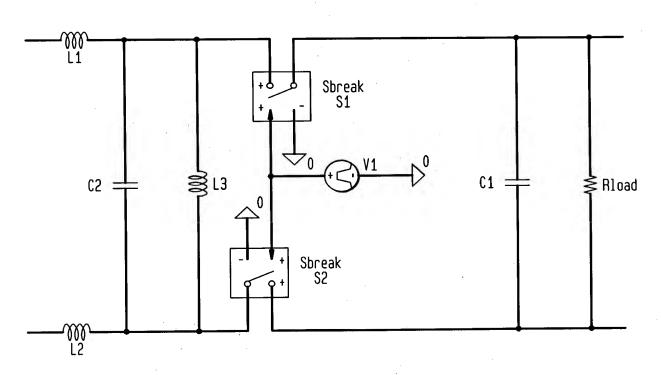
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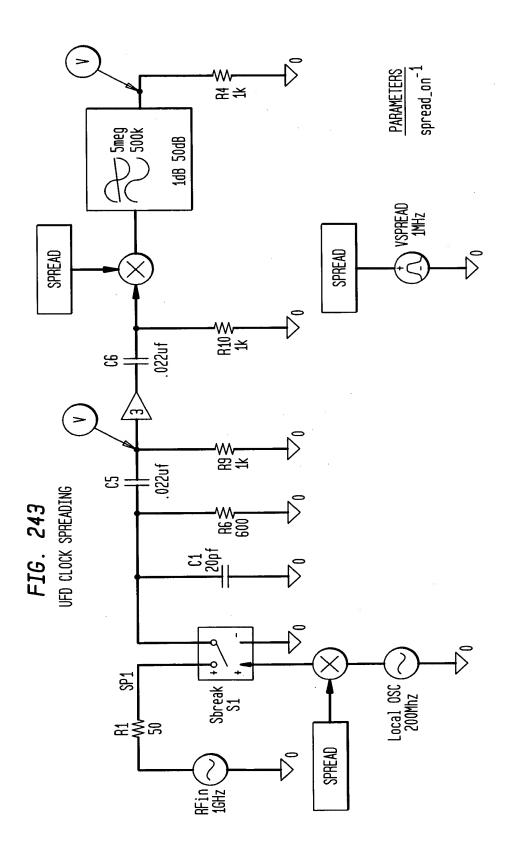
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FIG. 242
DIFFERENTIAL CONFIGURATION



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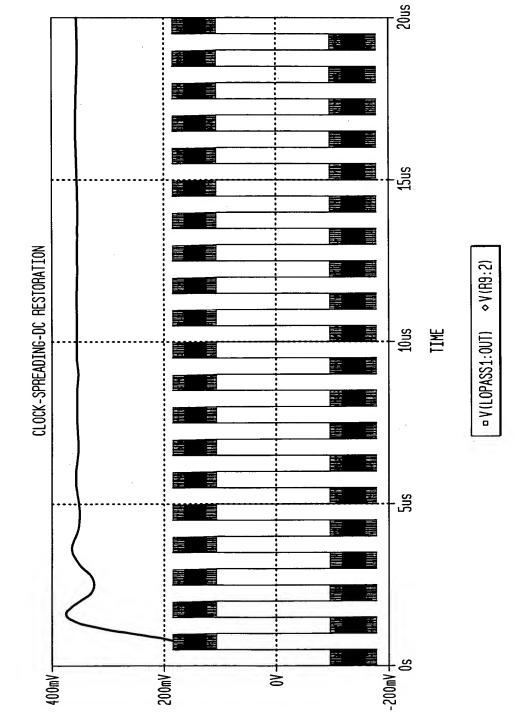
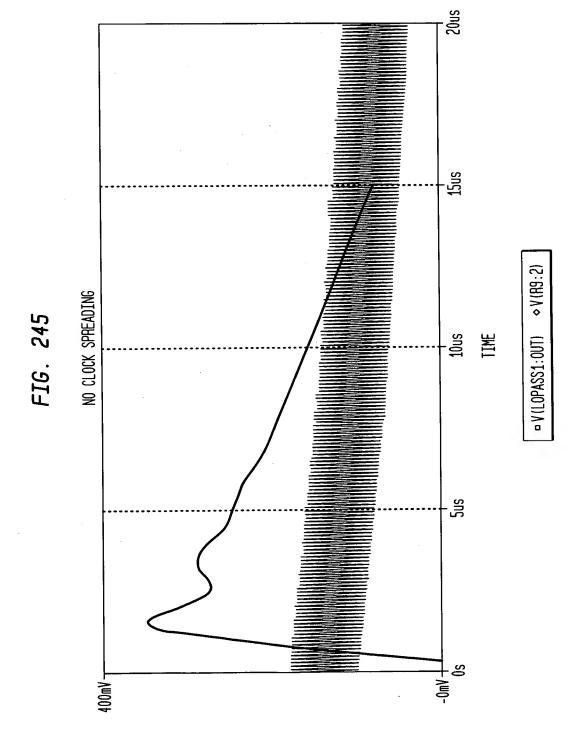


FIG. 244

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## FIG. 246

## B.B. RECOVERED I/Q WAVEFORMS WITH SLIGHTLY OFFSET CLOCK (CARRIER)

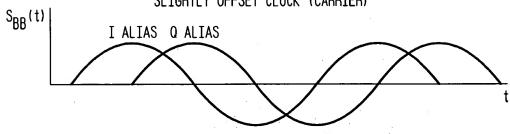


FIG. 247

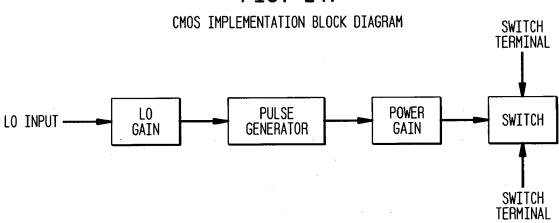


FIG. 248

LO GAIN BLOCK AT GATE LEVEL

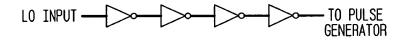
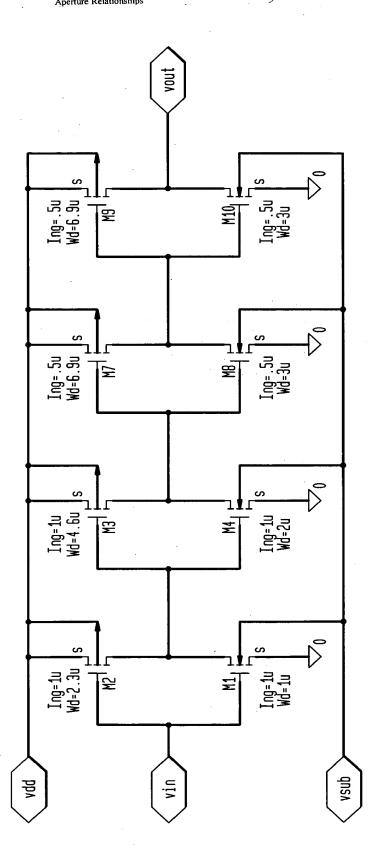


FIG. 249
LO GAIN BLOCK AT TRANSISTOR LEVEL



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FIG. 250
PULSE GENERATOR#1 AT GATE LEVEL

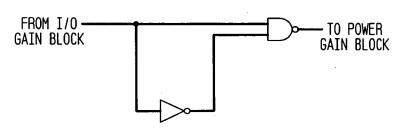
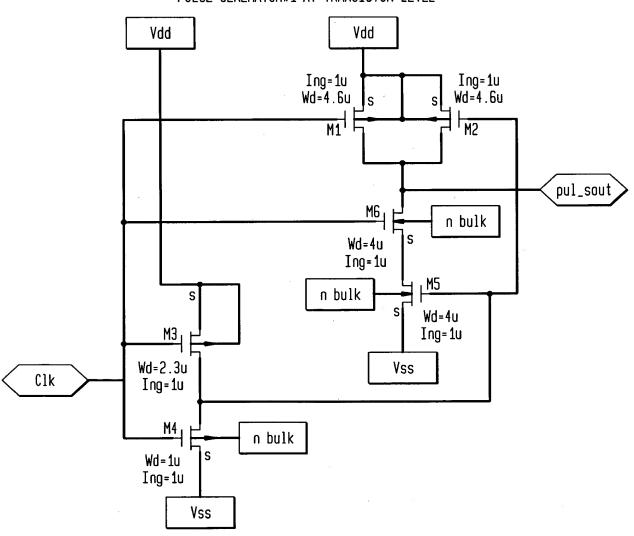


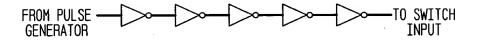
FIG. 251
PULSE GENERATOR#1 AT TRANSISTOR LEVEL



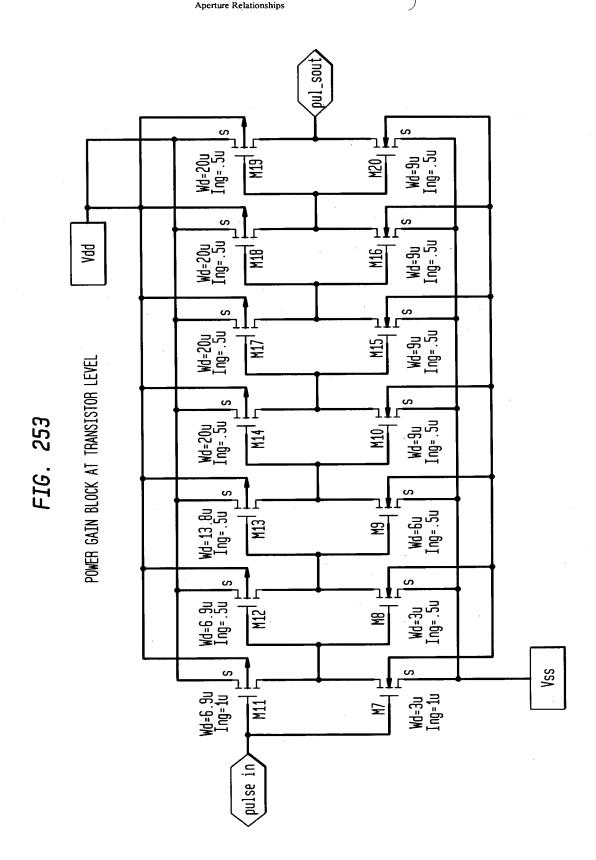
Replacement Sheet Replacement Sheet
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## FIG. 252

POWER GAIN BLOCK AT GATE LEVEL



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Aperture Relationships ୪ , M153 လ S M163 Wd=20u Ing=.5u ,M151 M162 S လ S Wd=20u Ing=.5u M161 FIG. 254
SWITCH AT TRANSISTOR LEVEL , M149 τ<u>.</u>.. S လ M150, L Wd=20u Ing=.5u M159 Wd=20u Ing=.5u , M147 S S တ Wd=20u Ing=.5u M157 M146 M156 S S S Ing=.5u Wd=20u Wd=20u Ing=.5u vsub

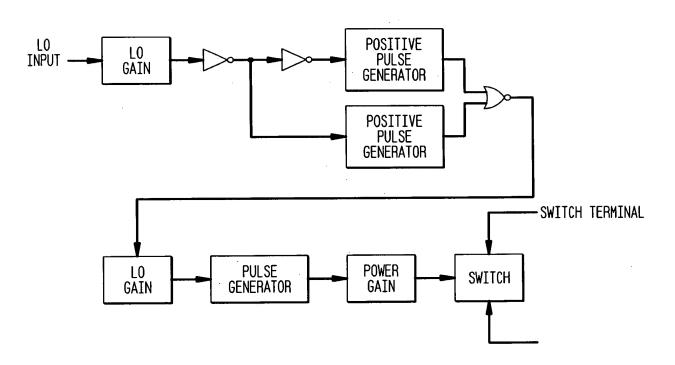
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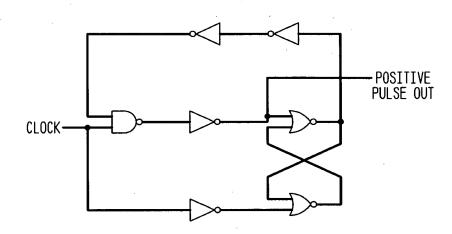
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FIG. 255 CMOS "HOT CLOCK" BLOCK DIAGRAM



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FIG. 256 POSITIVE PULSE GENERATOR AT GATE LEVEL



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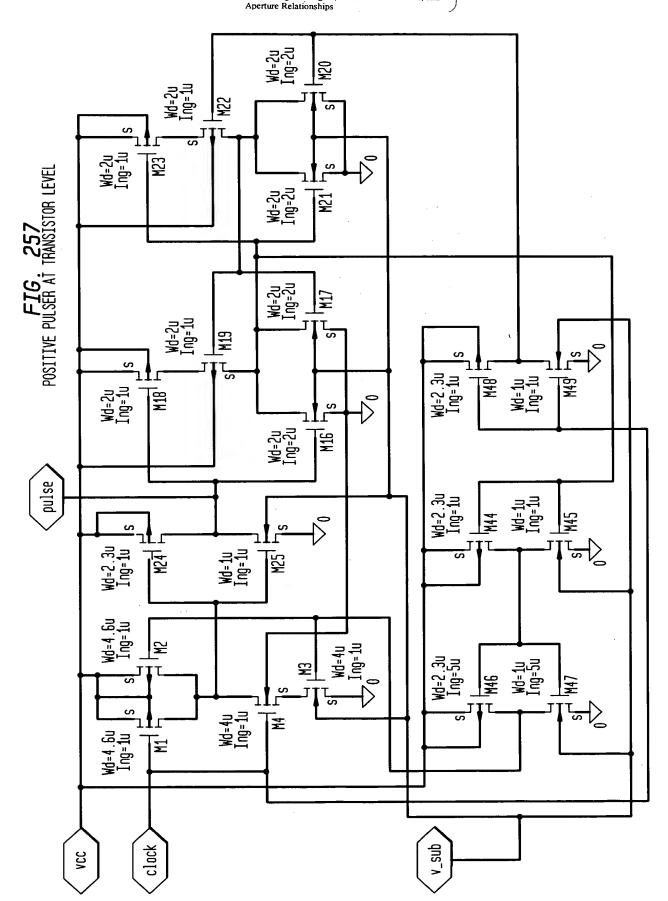
Appl. No. 09/550,644; Filed: Apr 14, 2000

Dkt No. 1744.0010009; Group Unit: 2688

Inventors: Sorrells et al.

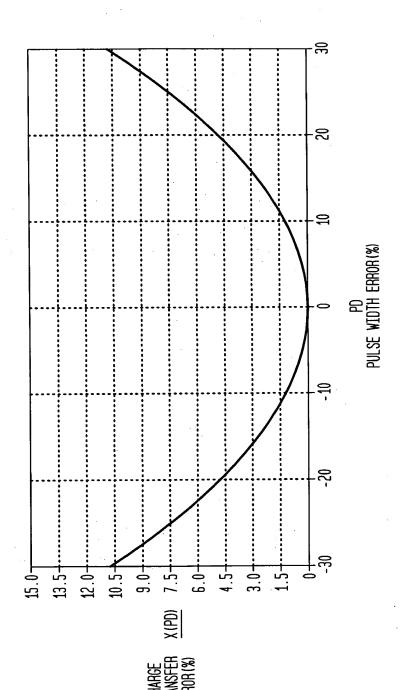
Tel. No.: 202-371-2600

For: Method and System for Down-Converting an Electromagnetic Signal, Transforms for Same, and

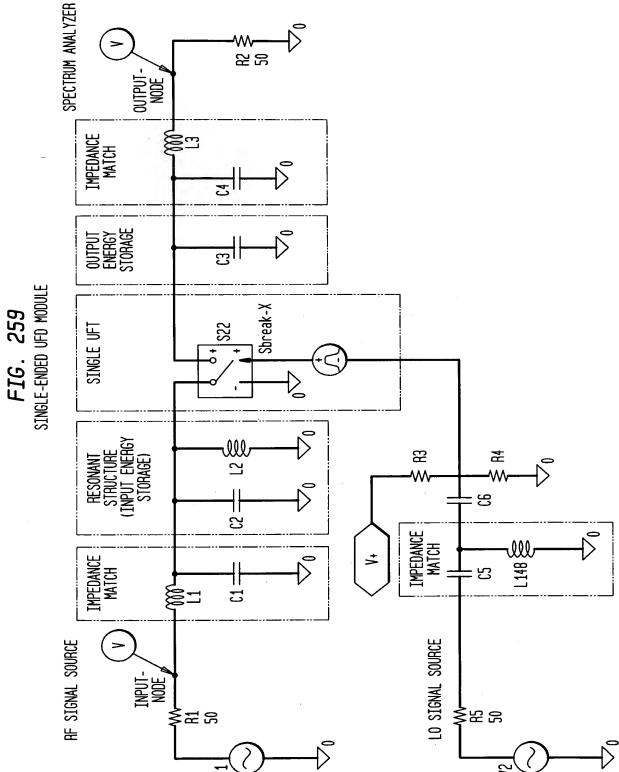


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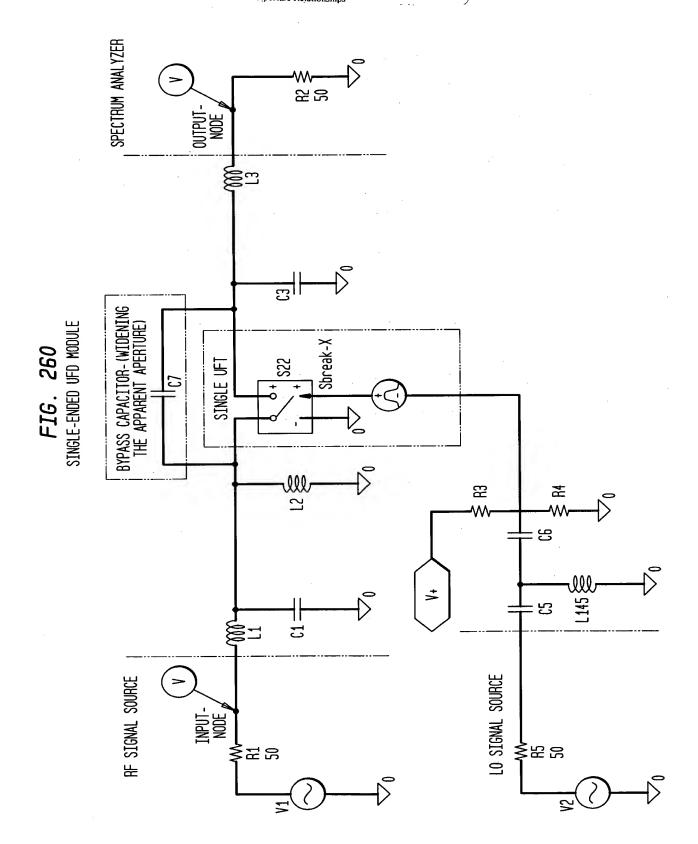
PULSE WIDTH ERROR EFFECT FOR 1/2 CYCLE



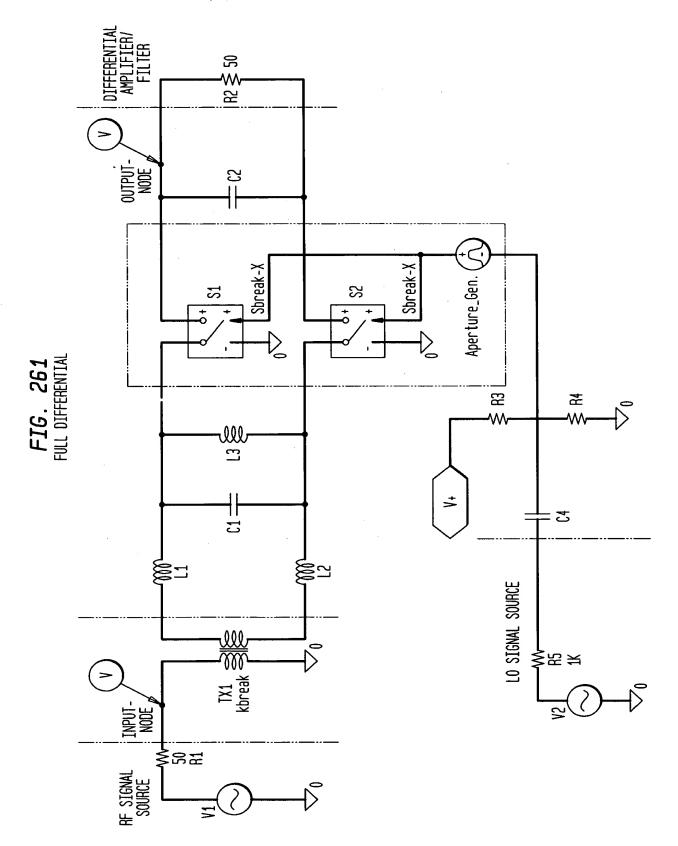
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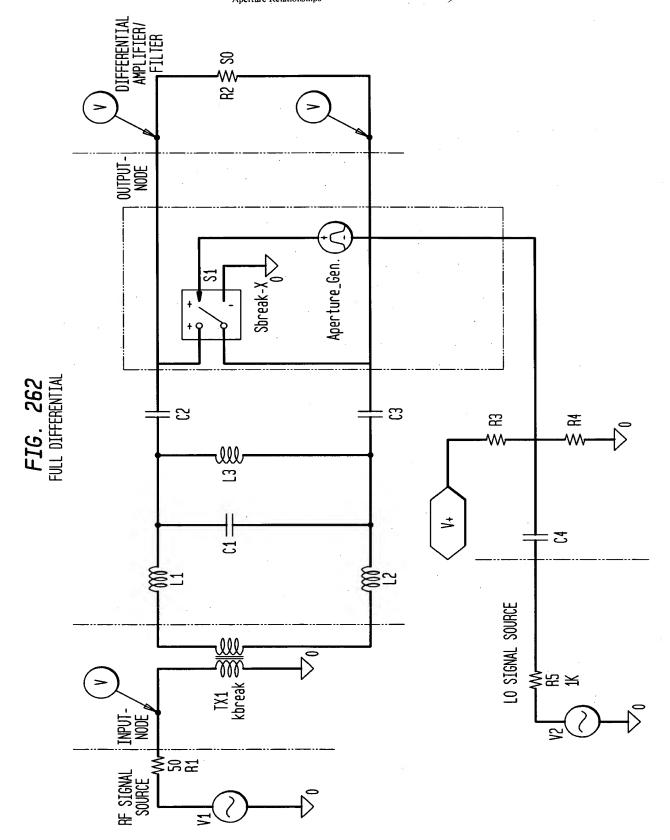
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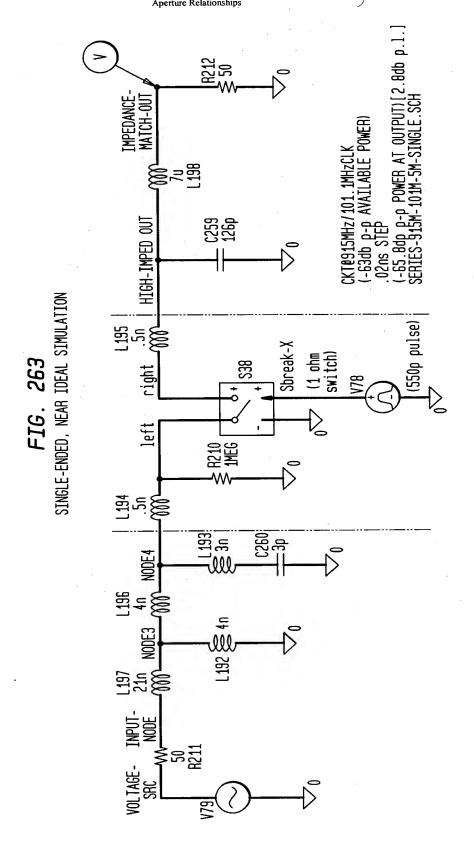
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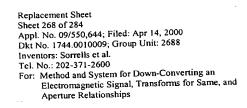


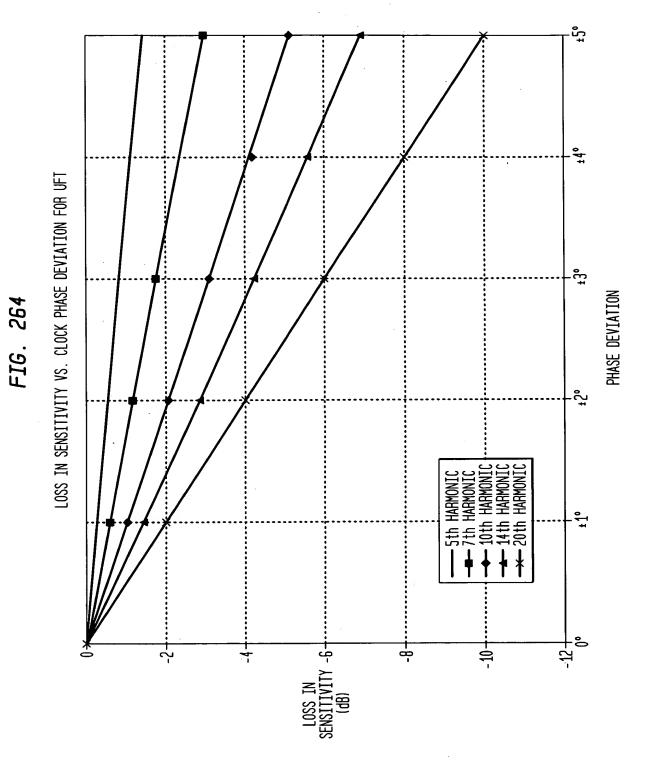
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Aperture Relationships

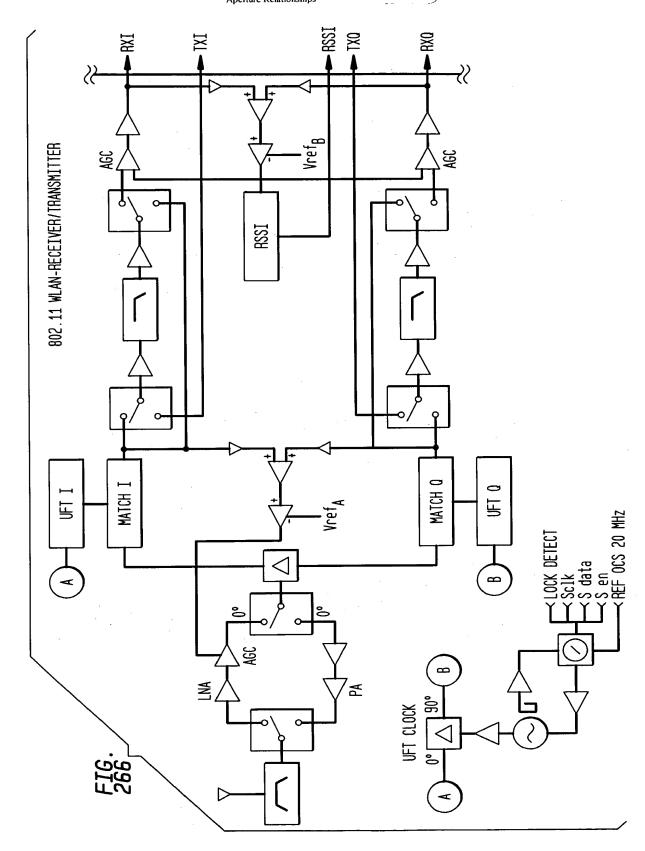






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Dkt No. 1744.0010009; Group Unit: 2688
Inventors: Sorrells et al.
Tel. No.: 202-371-2600
For: Method and System for Down-Converting an
Electromagnetic Signal, Transforms for Same, and
Aperture Relationships CONNECTOR BUS INTERFACE UNIT FIG. 265 DATA 0 SYNTHESIZER 490 MHz C1k 802.11 WLAN K A 띪 INPUT FREO RANG SENSITIVITY:

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FIG. 268

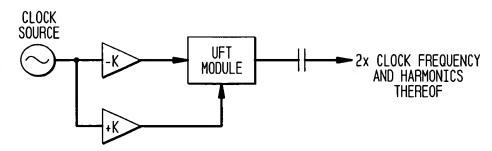


FIG. 269

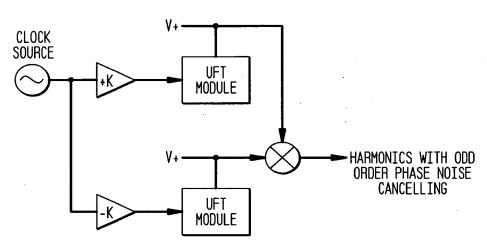
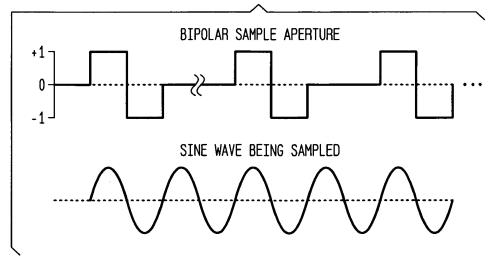


FIG. 270



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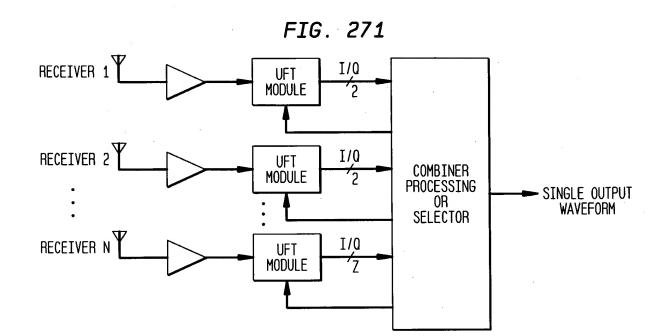
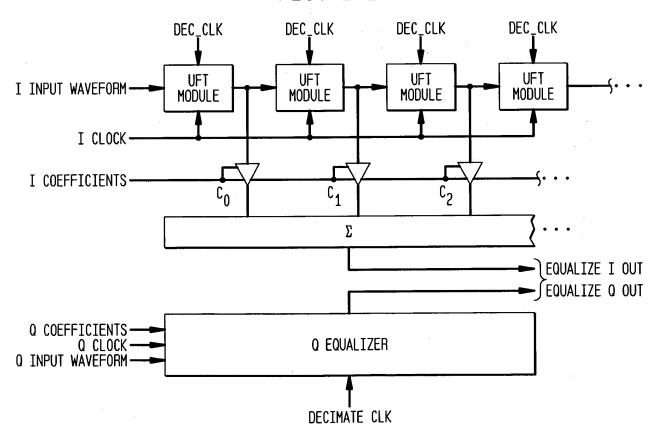


FIG. 272



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FIG. 273

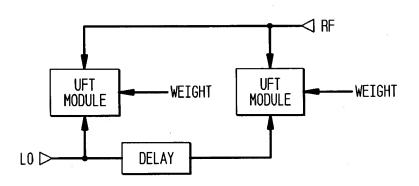
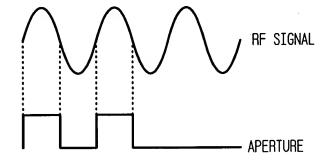


FIG. 274



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FIG. 275

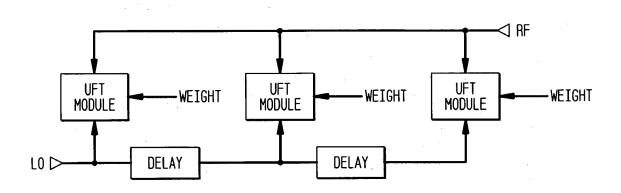
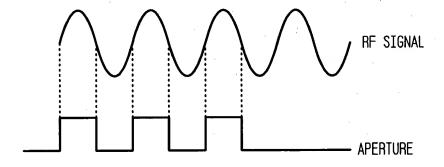
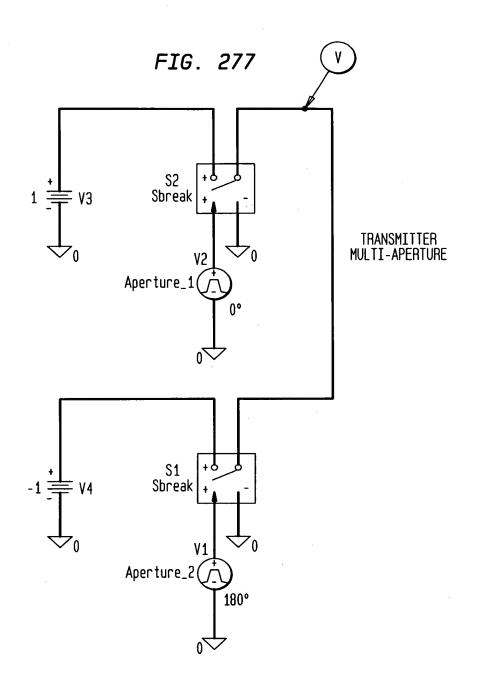


FIG. 276

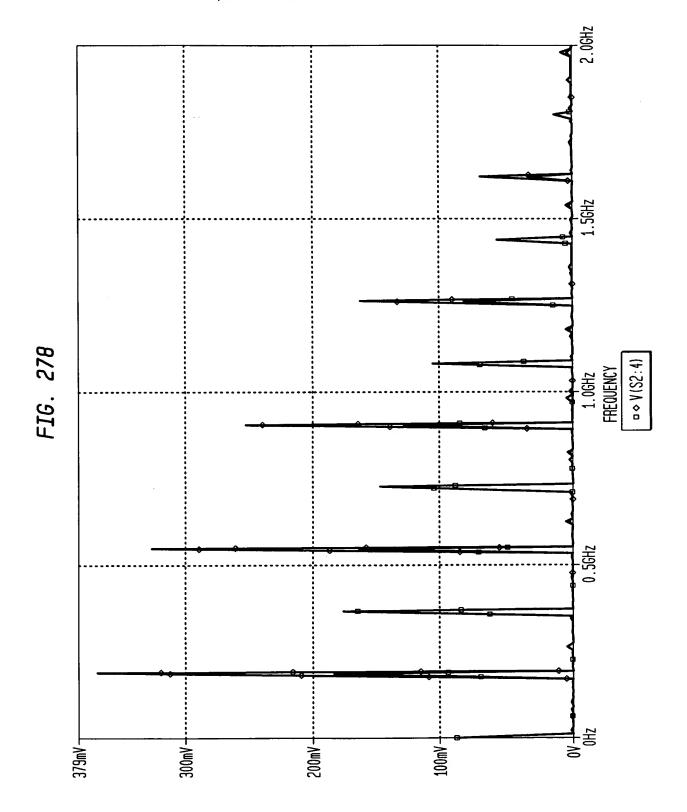


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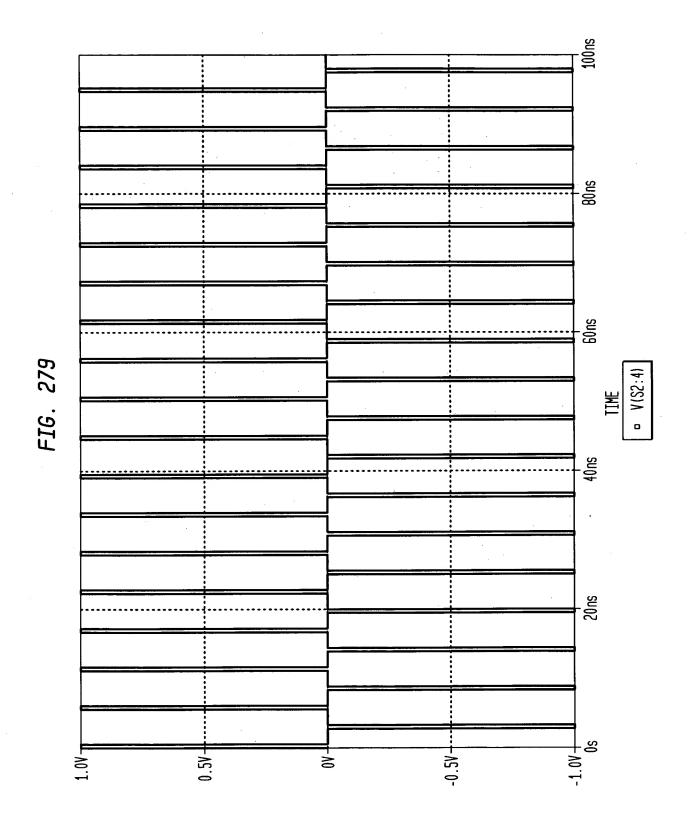
Tel. No.: 202-371-2600



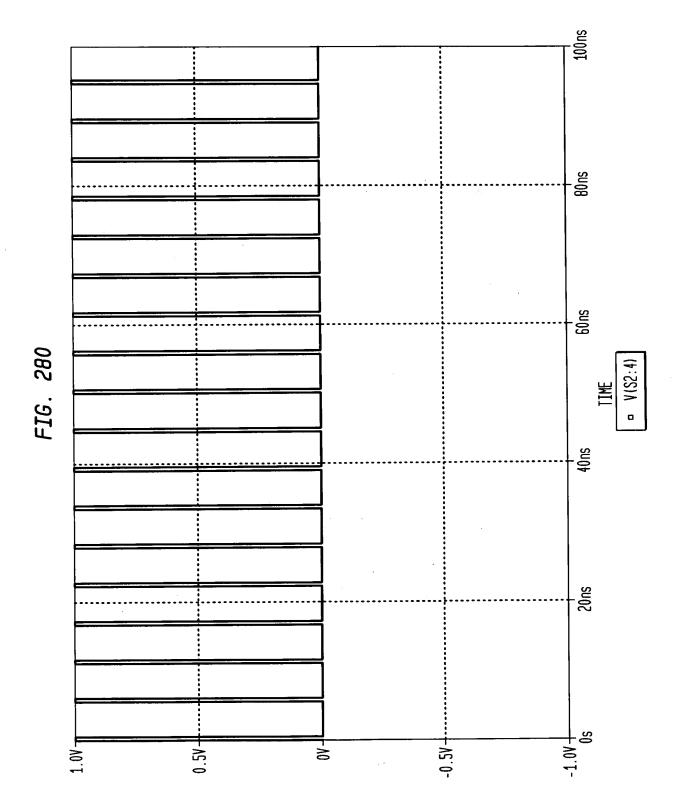
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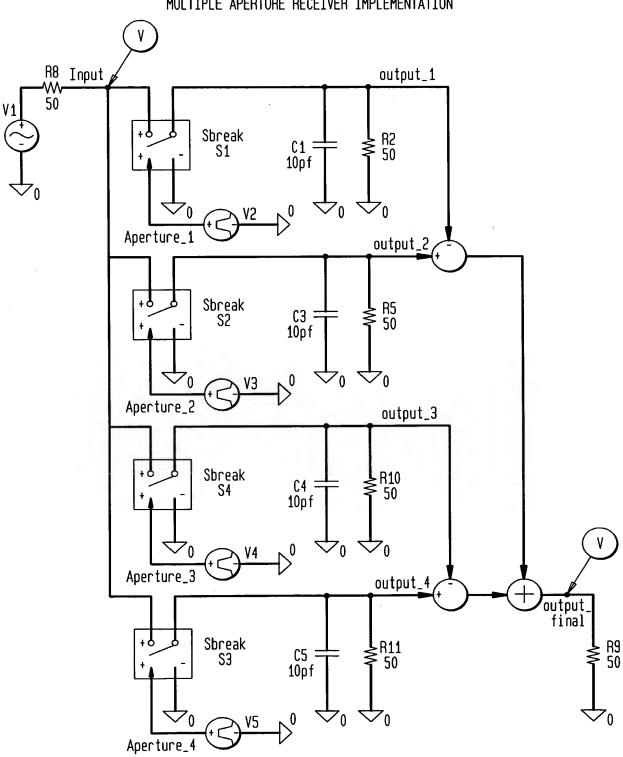


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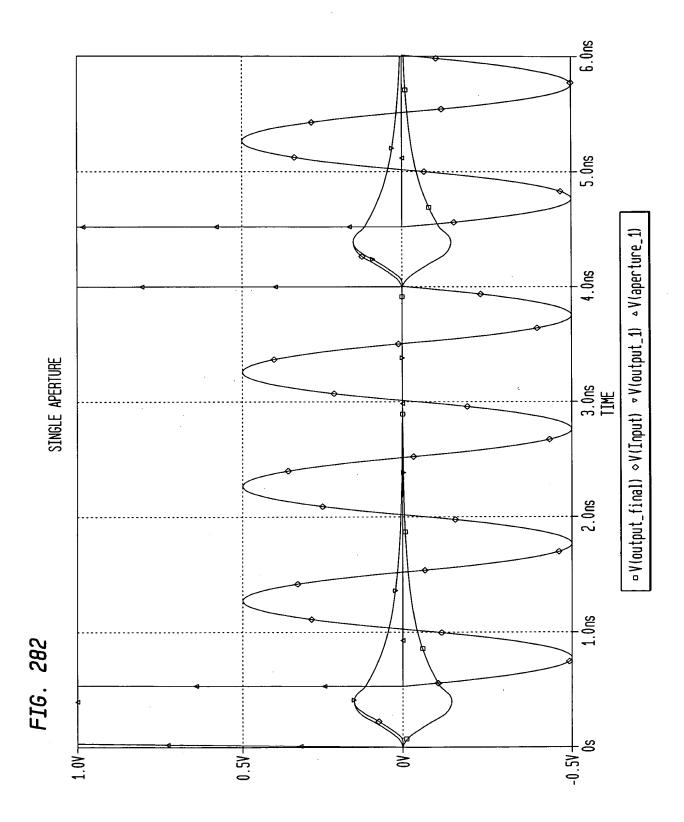


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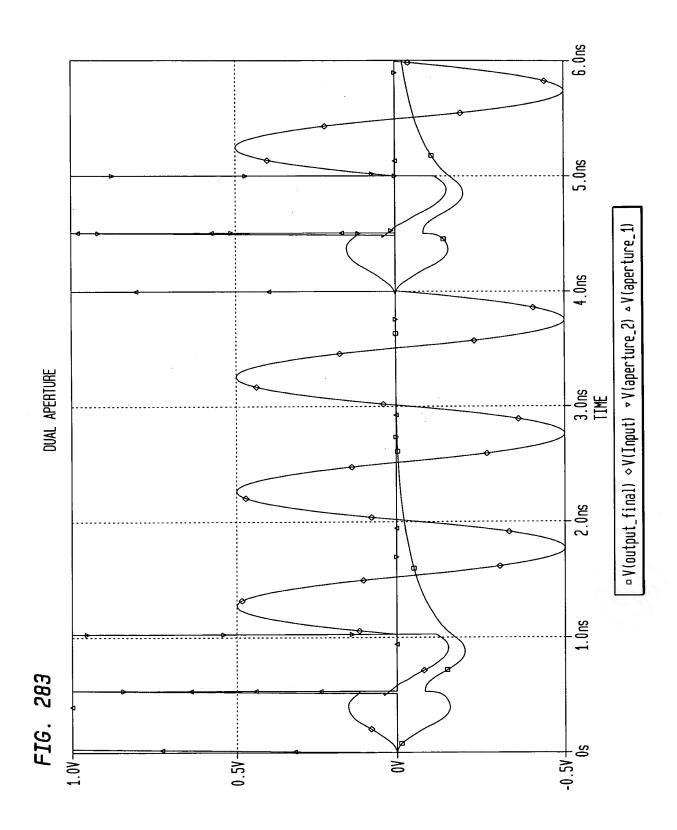
FIG. 281 MULTIPLE APERTURE RECEIVER IMPLEMENTATION



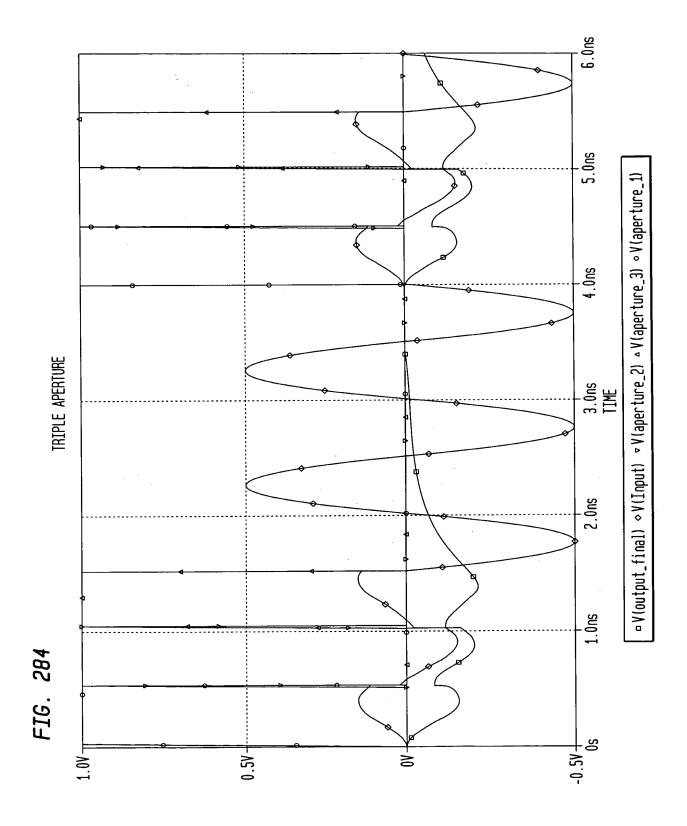
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